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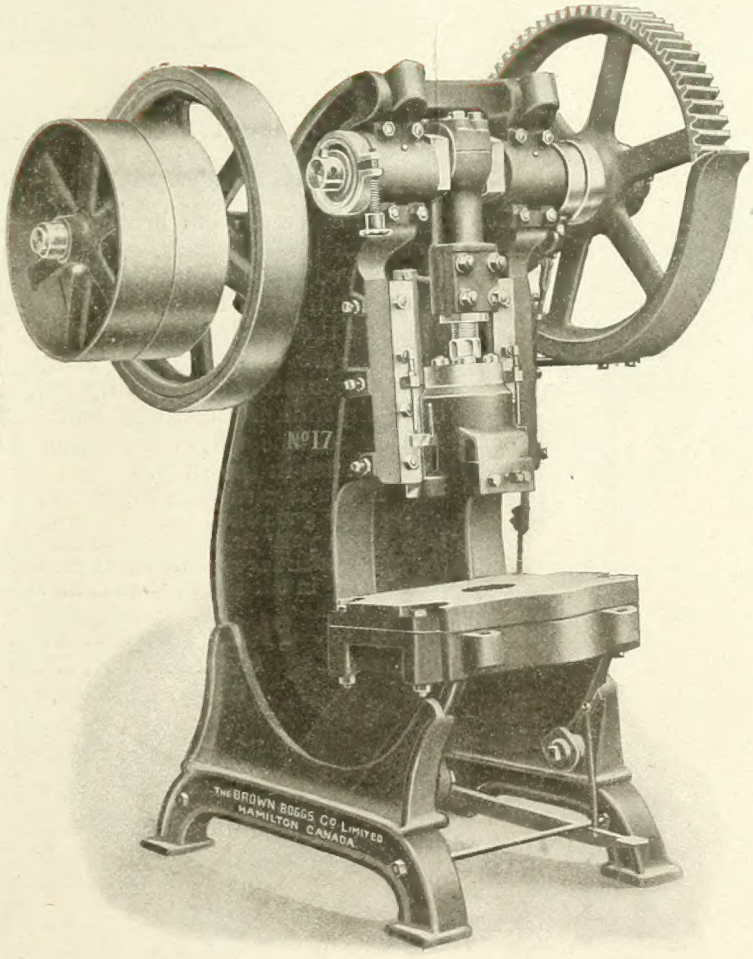
EDITORIAL INDEX—PAGE 543.
BUYERS' DIRECTORY—PAGE 145.
ADVERTISING INDEX—PAGE 164.

CANADIAN MACHINERY AND MANUFACTURING NEWS

A weekly newspaper covering in a practical manner the mechanical power, foundry and allied fields.
Published by the MacLean Publishing Company, Limited, Toronto, Canada

Vol. XXII., No. 23. Publication Office: Toronto, December 4, 1919. Subscription Price $3.00 per year.

For Your Pressing Needs





No. 215 Inclinable Geared Press

If you want maximum production install "BB" Presses. Shafts are made from high grade carbon steel forgings carefully heat treated. All wearing parts of clutch are tool steel. Clutch is four point instantaneous type.

B B Co Ltd.

The Brown-Boggs Co., Limited
Hamilton, Canada

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...shed weekly at 143-153 University Ave., Toronto, Canada. Sub-
...e Post Office Department, Ottawa, Canada. Entered as second-
...9.

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The Better the Man, the More He Appreciates Them—

Not only good when new, but heat treated and seasoned to maintain this goodness. Can be ground on face of cutting edge without affecting their size. That's why you'll find Pratt and Whitney Stay Bolt Taps on the job long after cheaper "just as good" tools are buried in the scrap pile.

Threads accurately and cleanly cut, with the least expenditure of time and effort, are other reasons why these better Taps are favorites in the shop.

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OF CANADA, LIMITED
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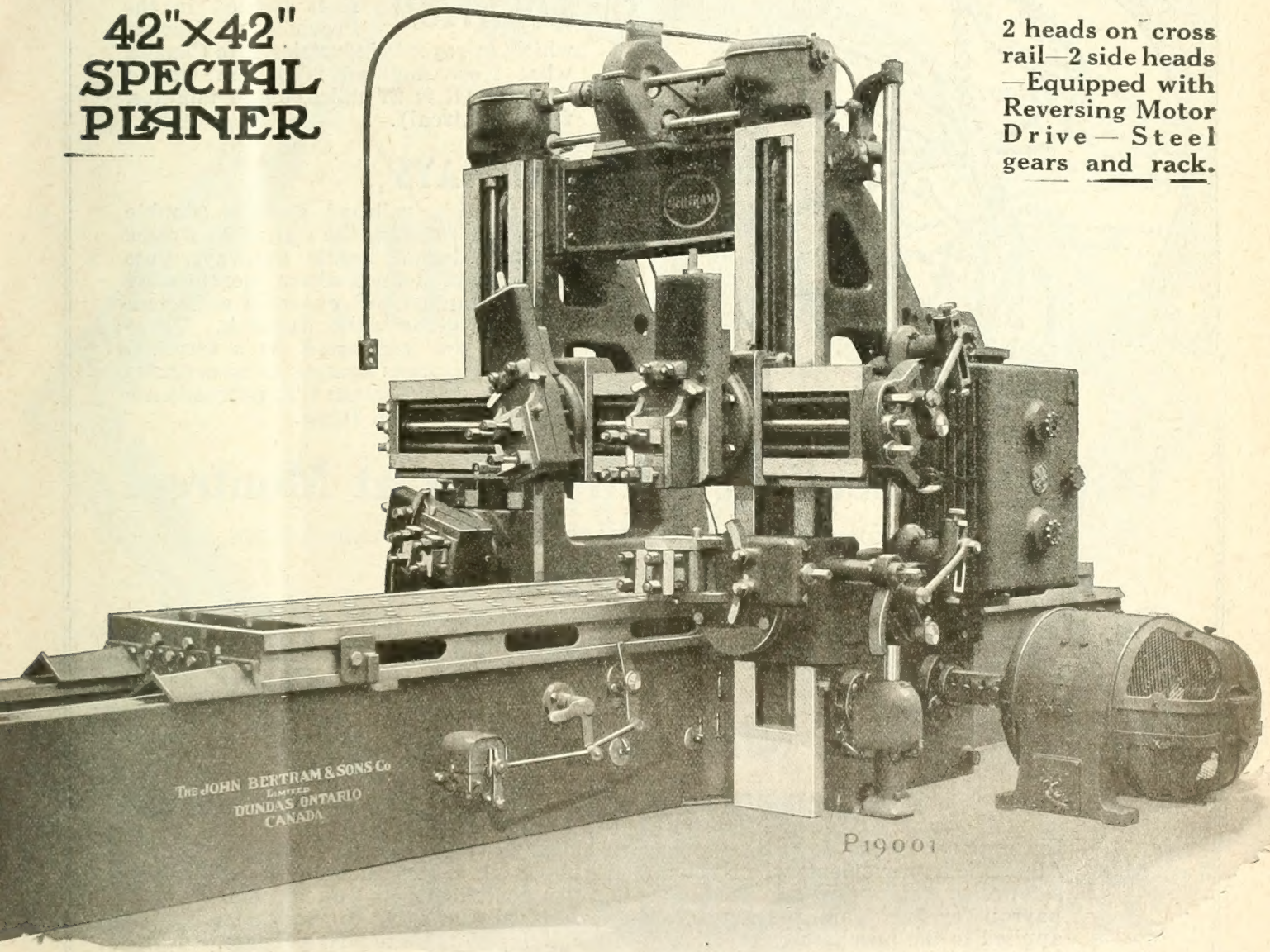
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The BERTRAM Page

MACHINE TOOLS

42"×42" SPECIAL PLANER

2 heads on cross rail—2 side heads—Equipped with Reversing Motor Drive—Steel gears and rack.



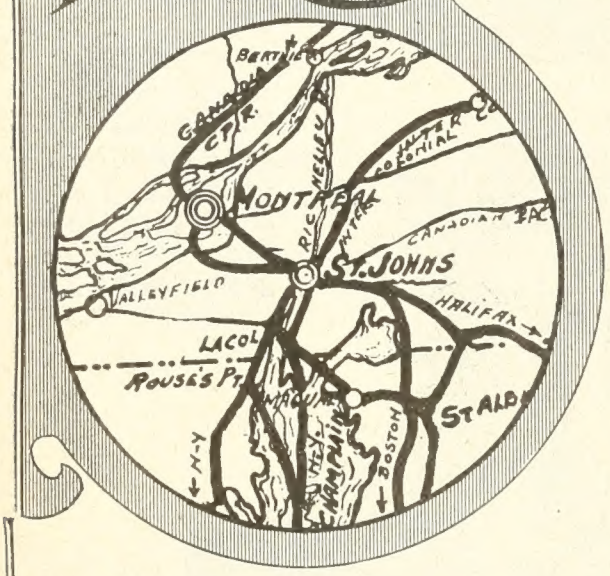
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Canadian Machinery and Manufacturing News, December 4th, 1919. Vol. 22, No. 23. Published weekly at 143-153 University Ave., Toronto, Canada. Subscription price in Canada, $3; United States, $3.50. Entered as second-class matter at the Post Office Department, Ottawa, Canada. Entered as second-class matter July 1, 1912, at the Post Office at Buffalo, under the Act of March 3rd, 1879.

The City of ST. JOHNS, QUEBEC



ITS LOCATION

It is located in the Province of Quebec which, as regards industries, is to Canada what New England is to the United States. (It is 27 miles, or 45 minutes, from Montreal).

ITS RAILWAYS

The two big railroad systems (double track) of Canada, the Canadian Pacific and the Grand Trunk Railways, pass through St. Johns, where merchandise can be shipped and exported anywhere upon the globe with dispatch. These railways are connected by a terminal switching system: charges at exceedingly low rate. All Eastern U.S. railroads are connected with St. Johns.

Direct Connections with Docks at Montreal

Goods can be exported direct by steamers to European, South African, South American and West Indian Ports.

St. Johns has long been recognized as the cheapest labor centre in Canada. Reasonable rents and living costs are keeping it so even in these times.

No other locality offers the following inducements to new industries---but we do

Exemption of taxes for fifteen years' period that is subject to extension. All public improvements which you may require, such as extension of streets, sidewalks, waterworks and sewerage; five per cent. bonus to you on your payroll for five years and if you wish we will advance this to you to be applied to the purchase or erection of any building suitable to your purpose.

For more specific information write to

The Secretary of the City Council

St. Johns, Quebec, Canada

By Product Coke

Hamilton Pig Iron

Open Hearth
Steel Billets

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Drop
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Quality

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STEEL COMPANY
OF
CANADA
LIMITED
HAMILTON MONTREAL

Service

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Fastenings

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Pipe

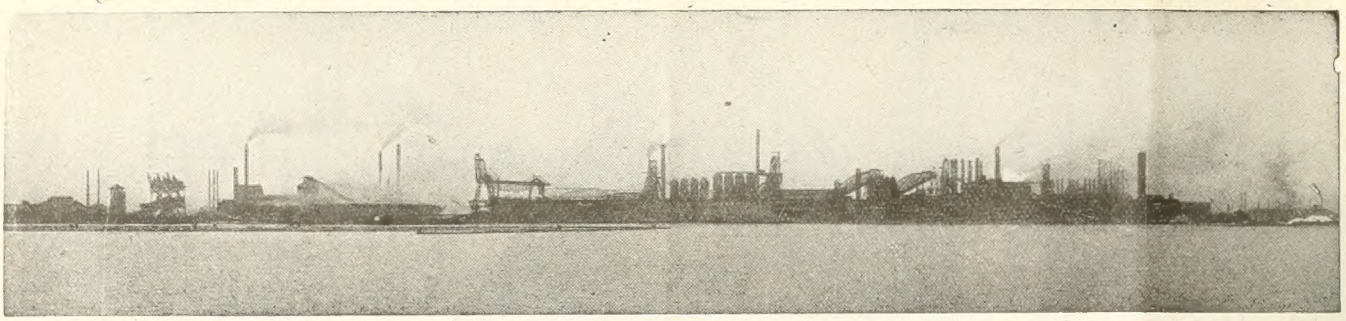
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Bolts Nuts & Washers

Wire & Wire Products

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General View of the Plant of the Algoma Steel Corporation from the Waterfront.

ANNOUNCEMENT

MARK OF ALGOMA O.H. QUALITY

THE ALGOMA STEEL CORPORATION, LIMITED, take pleasure in announcing to their customers and the Canadian trade that in accordance with the widespread desire throughout the Dominion that there should be obtained in Canada with Canadian labor, a much larger proportion of the requirements of this country in STEEL SECTIONS for STRUCTURAL PURPOSES, CAR CONSTRUCTION, SHIPBUILDERS' REQUIREMENTS, etc., they are just completing extensive alterations and additions to their rolling mills, and on or about 1ST NOVEMBER, will be ready to produce and ship American Standard Sections of BEAMS and CHANNELS up to and including 15", all standard sections of ANGLES from 6" x 6" down to 1¼" x 1¼", ZEE BARS for car builders and general purposes, small and large ROUNDS and SQUARES, and FLAT BARS up to 14" wide. The quality of the product is already well known to the trade, and is exclusively steel made by the Open Hearth process, and can be furnished in all grades from the softest rivet stock to high carbon special spring material.

The following are the sections which will be rolled:---

ANGLES—Equal Leg—
6 x 6"—5 x 5"—4 x 4"
3½ x 3½"—3 x 3"
2½ x 2½"—2¼ x 2¼"
2 x 2"—1¾ x 1¾"
1½ x 1½"—1¼ x 1¼"

ANGLES—Unequal Leg—
6 x 4"—6 x 3½"—5 x 4"
5 x 3½"—5 x 3"—4½ x 3"
4 x 3½"—4 x 3"—3½ x 3"
3½ x 2½"—3 x 2½"—3 x 2"
2½ x 2"

BEAMS—
15", 12", 10", 8", 6", 5", 4", 3".

CHANNELS—
15", 13", 12", 10", 8", 6", 5", 4", 3".

ZEES—
3¼ x 5 x 3¼ x 5/16
3 5/16 x 5 1/16 x 3 5/16 x ⅜"
3⅜ x 5⅛ x 3⅜ x 7/16"
3 1/16 x 4 x 3 1/16 x ¼"
3⅛ x 4 1/16 x 3⅛ x 5/16"
3 3/16 x 4⅛ x 3 3/16 x ⅜"
2 11/16 x 3 x 2 11/16 x ¼"
2¾ x 3 1/16 x 2¾ x 5/16"

ROUNDS—
All sizes from ½" up to and including 4".

SQUARES—
All sizes from ½" up to and including 3".

FLATS—
All sizes from 1 x ¼" up to and including 14" wide.

MINE RAILS—
All sections from 12 lbs. up to and including 45 lbs. per yard.

PIG IRON—
Machine cast FOUNDRY MALLEABLE and BASIC.

SULPHATE OF AMMONIA.
NITRE CAKE.

For the better convenience of customers who may find it necessary to secure rush shipments of particular items, they contemplate keeping a large stock of all the various standard sections constantly on hand, and to this end extensive warehouse facilities are being prepared.
Your enquiries and business will be appreciated.

ALGOMA STEEL CORPORATION

SAULT STE. MARIE, ONTARIO

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Every Wilt Drill is Thoroughly and Scientifically Inspected efore it is Delivered to You

Every WILT HIGH-SPEED AND CARBON TWIST DRILL is made from the very best materials by highly skilled workmen—THEN they are thoroughly and scientifically inspected after each operation.

This is the best GUARANTEE you can have that the drill delivered to you is as near perfect as it is possible to make a drill. In handling WILT DRILLS you are therefore fully protected and can guarantee to your customer that in selling him a WILT DRILL you are giving him

THE BEST THAT MONEY CAN BUY.

WILT HIGH-SPEED AND CARBON TWIST DRILLS are being used in the majority of the largest plants in Canada —and to a large extent **EXCLUSIVELY.**

IT WILL PAY YOU TO BUY AND SELL THEM.

"WHERE THERE'S A WILT —THERE'S THE WAY."

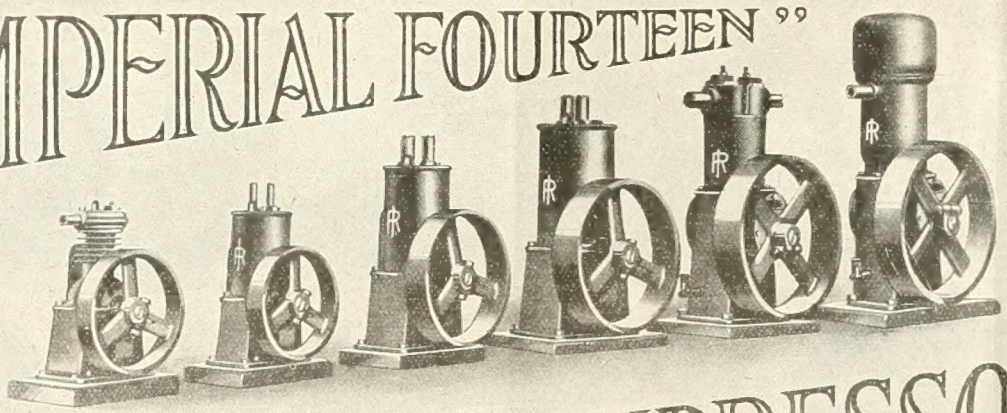
WILT TWIST DRILL CO. OF CANADA, LIMITED

Walkerville - - - Ontario

London Office: Wilt Twist Drill Agency, Moorgate Hall, Finsbury Pavement, London, E.C. 2, England

HIGH SPEED AND CARBON TWIST DRILLS

"IMPERIAL FOURTEEN"



AIR COMPRESSORS

Haven't you often wished for a Small Compressor for

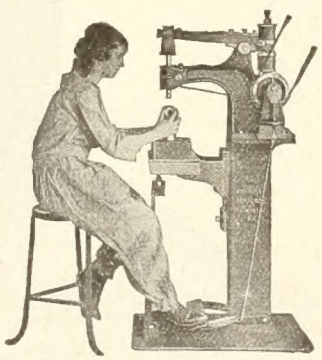
Cleaning Motors and Generators, Spraying Paint or Varnish, Blowing Chips Off Lathes, Running a Sand Blast, Operating an Air Hoist or One or Two Air Tools, Raising Water From a Well or Dyes, Acids, etc., in the Plant; Agitating Solutions, Blowing Oil Fired Furnaces, Tooting Whistles or a Hundred and One Other Little Jobs.

"Imperial" Fourteens are made for just such work as this, with the same care and attention to details that have always been characteristic of compressors of our make. May we send you a copy of Bulletin 3039 describing these handy little machines?

CANADIAN INGERSOLL-RAND COMPANY, LIMITED

Sydney Sherbrooke Montreal Toronto Cobalt Winnipeg Nelson Vancouver

The Hammer With The Human Stroke



HEADS RIVETS COLD

Heads 'em tight or loose, flush, countersunk, or finishes heads any shape desired, and at the rate of:—

A rivet a second, sizes up to 3/16".
A rivet in two seconds, size ¼" to ⅜".
A rivet in three seconds, size 7/16" to ⅝".

And on special order we build machines to handle rivets up to 1½" with proportionate rapidity.

Built in eight sizes.

Besides riveting, the High Speed Riveting Hammer does all kinds of peining, swaging, upsetting, etc.

Send us sample assembly parts with rivets or sketch of your work,

and

Let us shoulder your riveting problems.
Send for the High Speed Hammer Book.

THE HIGH SPEED HAMMER COMPANY, INC.
ROCHESTER, N.Y.

Every Emery Wheel With Its Own Dresser



Desirable, isn't it, now that cost is no objection? For with an inexpensive Desmond-Stephan Dresser for every wheel, every wheel will be touched up frequently and so kept true and equal to its original cutting efficiency.

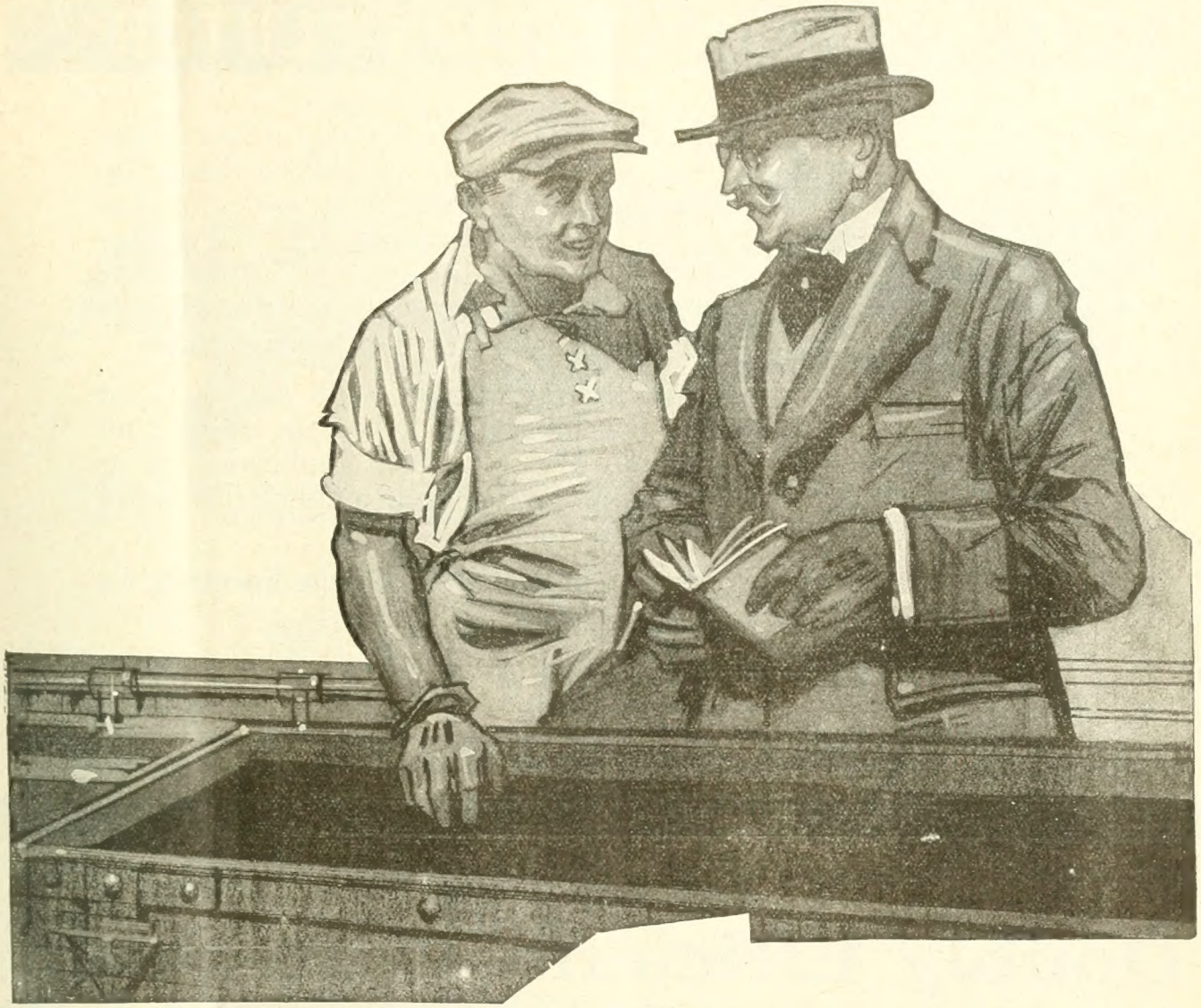
For all ordinary shop grinding wheels specify **"Diamo-Carbo"** —the perfect diamond substitute.

For large, coarse, hard wheels ask for the **"Desmond-Huntingdon."**

Sherman Corrugated, 2 sizes
Norton Zig-Zag, 2 sizes
Magazine
Diamonds

The Desmond-Stephan complete line of Economical Grinding Wheel Dressers is catalogued. Write for copy.

The Canadian Desmond-Stephan Mfg. Company
HAMILTON, ONTARIO
Alfred Herbert, Limited, Coventry, Agent for Great Britain



"We have cut our cleaning time more than half"...

"THE OAKITE in that tank does it.

This Advertisement is one of a series based on actual occurrences.

"The day the Oakite man came here, we were cleaning steel automobile bumpers which were covered with emery and oil. We were about 300 behind and were only turning out about five or six an hour, because we had to brush them.

"The Oakite man made up three tanks with Oakite and we caught up on our back work in *one day*—eliminating brushing—and we have never been a single piece behind since."

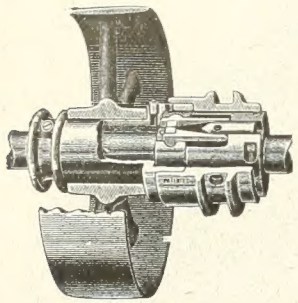
In seeking advice on cleaning problems, look for broad experience and ability. It is the surest, safest way to find sound counsel, yes—and plans, methods and materials too, that fit your particular needs.

How may we serve you?

OAKITE MANUFACTURED BY
OAKLEY CHEMICAL CO.
44 THAMES STREET · NEW YORK

If interested tear out this page and place with letters to be answered.

THE JOHNSON FRICTION CLUTCH



Standard Single Clutch with Pulley Mounted on Hub —Clutch Engaged.

MANUFACTURERS who are particular about keeping an established reputation equip all their machines with Johnson clutches. They recognize that superiority must be consistent in order to count. And Johnson clutches assure them of uniformly good service wherever they are installed.

Other clutches might work well in some cases—but Johnson clutches are *sure* for all purposes. We study each application on its own conditions, and build a clutch that is just right for the job.

When you are tired of experimenting, let us have a chance.

WRITE FOR OUR YELLOW DATA SHEETS

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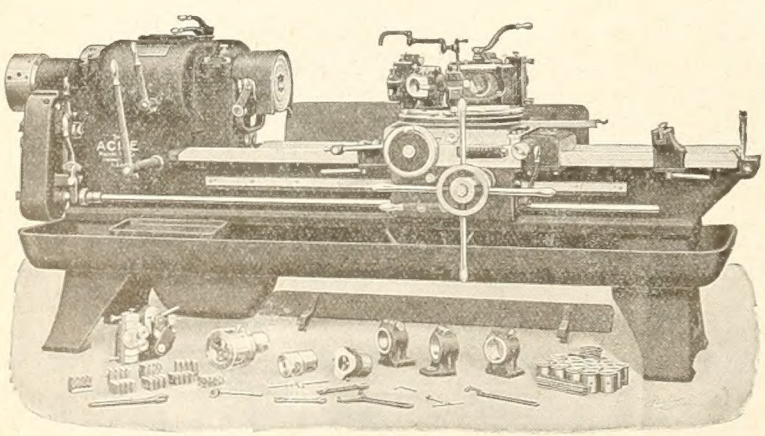
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CANADIAN FAIRBANKS-MORSE CO., LIMITED, Montreal, Toronto and Winnipeg.

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.

Doubly Efficient—Does Both Bar and Chuck Work

This Cincinnati Acme Flat Turret Lathe is a double-production, geared head machine of the sliding gear type. It operates on minimum power because the only gears running are those doing the actual work.

This machine saves remarkable time and labor machining either bar work or chuck work up to 16 in. diameter.



3¼ in. x 36 in. Flat Turret Lathe, Equipped for Bar Work.

Head is cast solid with the bed. You know what that means: accuracy, rigidity, constant and perfect alignment of spindle with vees, upon which the turret carriage travels.

We also make a full line of Screw Machines and Turret Lathes.

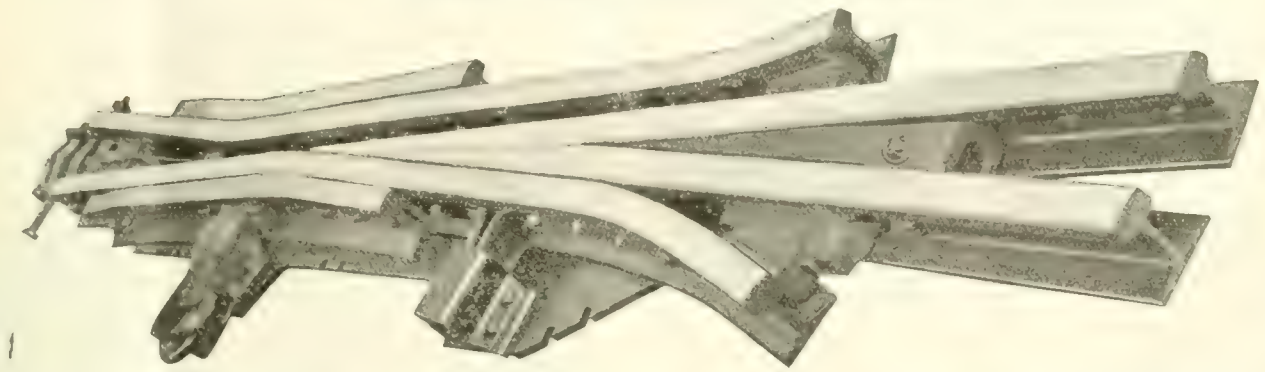
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The Acme Machine Tool Co.
Cincinnati, Ohio

Canadian Agents: Rudel-Belnap Machinery Co., of Montreal and Toronto

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For Steam and Electric Railways



Built-Up Intersections
Frogs Switches
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Mates Diamonds
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Crosses Switchstands

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Insures Maximum Production

FIRTH'S CARBON TOOL STEELS
Standard Brands Highest Quality

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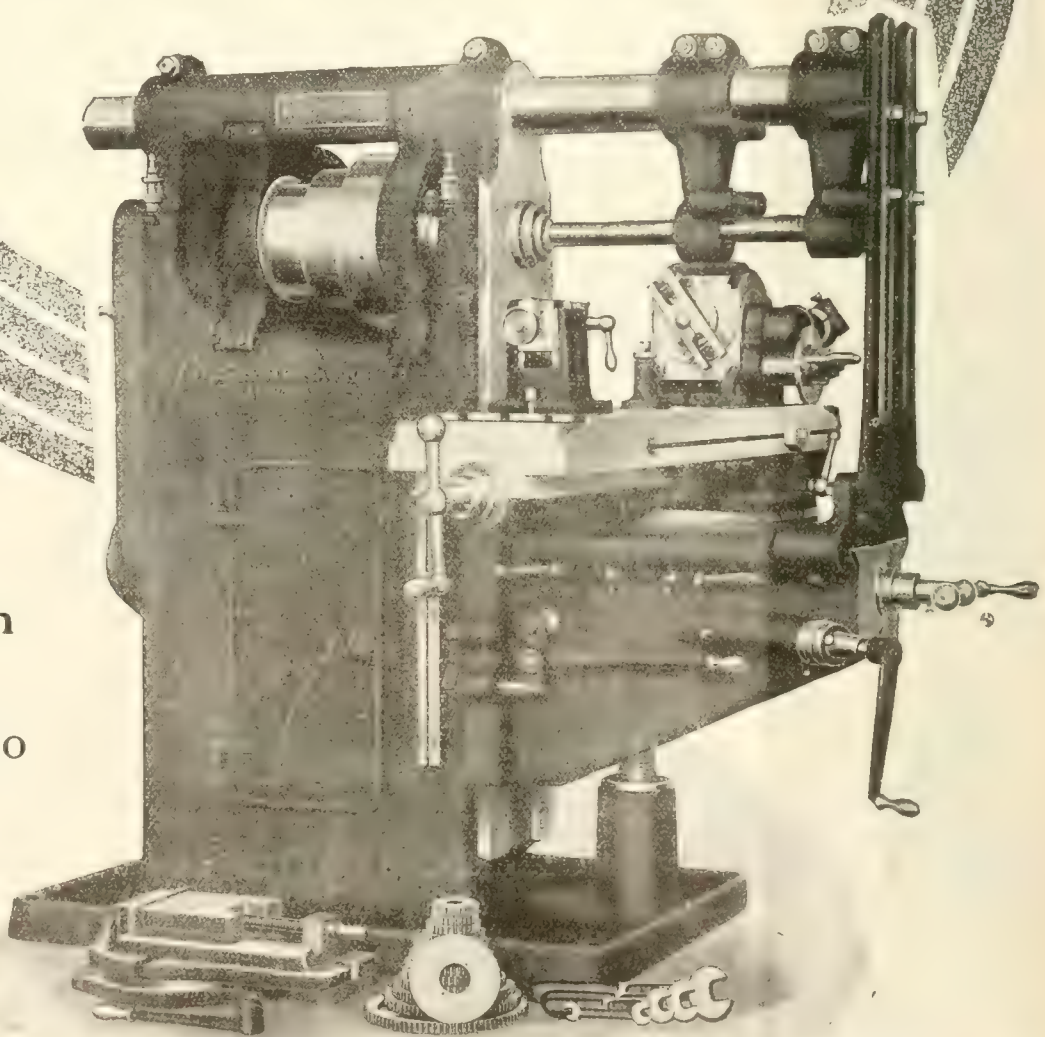
JOHN J. COLEMAN
Canadian Manager

FORD-SMITH MILLERS

AND ATTACHMENTS

The Miller of high-grade construction—fast, accurate and durable.

Adapted for Heavy Manufacturing or the most exacting tool room service. A suitable Range and Capacity for every class of milling.



Manufactured by

The Ford-Smith Machine Co.
Limited
HAMILTON, ONTARIO
Canada

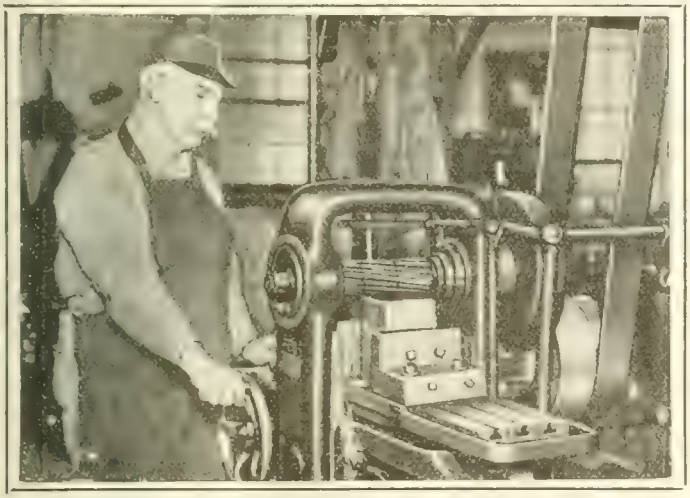
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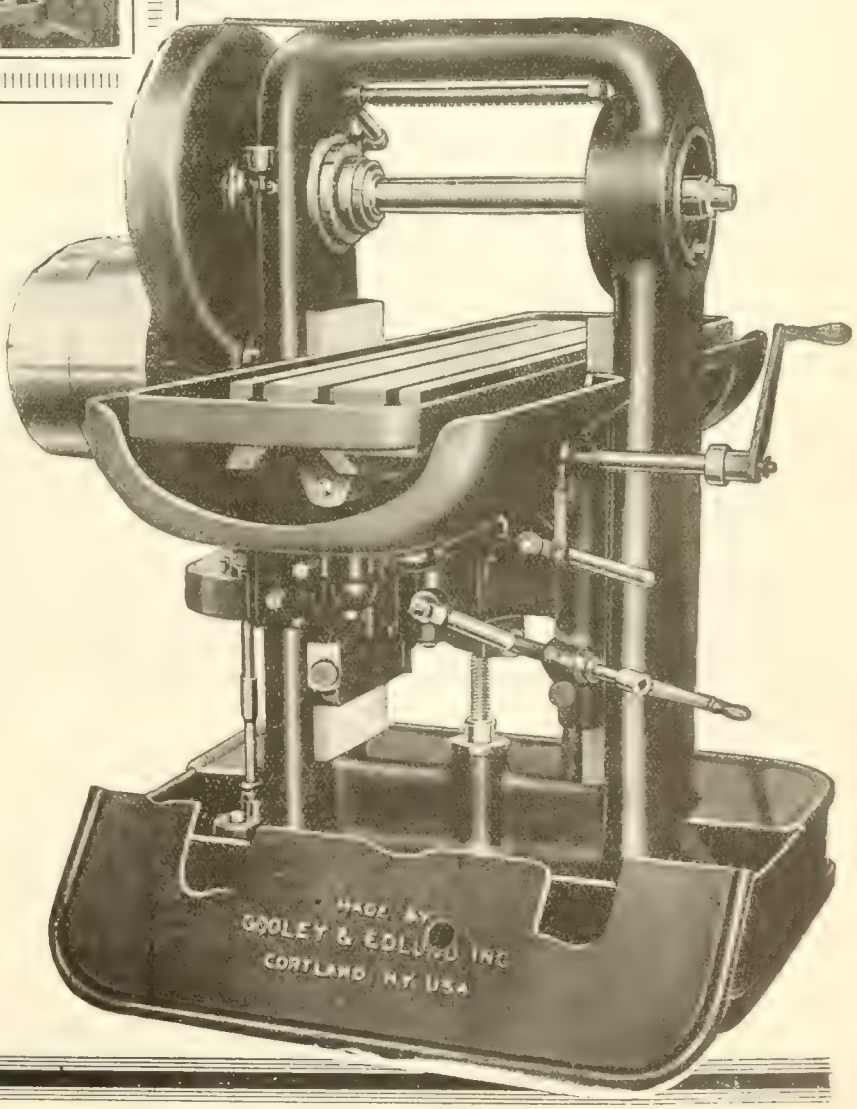
Gollin & Co., Melbourne,
Australia

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BRIGGS MILLER

Keeps Five Die Sinkers Going





HERE you see the Briggs Miller Squaring Die Blocks, and it is working so fast it keeps five die sinkers going.

Some are new, squared from the rough; some are old, annealed, cut down and made over; some are oblong, some square, in sizes up to 9 inches. This Briggs Miller has been squaring blocks for four years; has never given any trouble. When cutters get dull the operator has another gang ready to go on with the work. Unusual rigidity accounts for Briggs' higher efficiency.

Don't you think you could use this tool to advantage in your shop? Write for the details.

Gooley & Edlund, Inc.

Cortland, N.Y., U.S.A.

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Toronto, Ont.

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BRANDS OF ALLOY & TOOL STEELS

In Billets, Bars, Sheets, Hot and Cold Rolled Strips, Cold Drawn Cast Steel, Wire and Drill Rods

HIGH GRADE STEEL FOR ALL PURPOSES

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FOUNDRIES & FORGINGS
LIMITED

ENDURANCE TOOLS
NEVER WEAR OUT

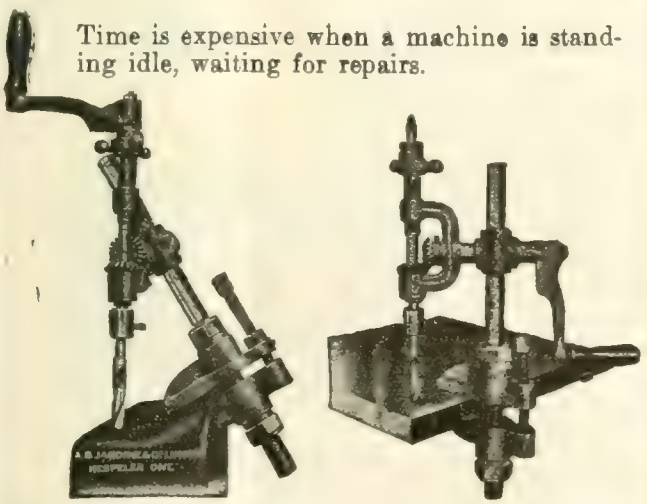


PIPE THE WRENCH—WRENCH THE PIPE

Canadian Billings & Spencer Plant
Welland, Ont.

Jardine Universal Ratchet Drill

Time is expensive when a machine is standing idle, waiting for repairs.



On the average repair job, this machine completes the drilling in less than the time required to set an ordinary ratchet to begin.

Weight, 40 lbs. Price, $26.50 net

Sold by all Machinery and Supply Houses

A. B. JARDINE & CO., Limited
HESPELER, ONTARIO

LOCOMOTIVE AND CAR WHEEL TYRES

HIGH-SPEED AND CARBON
TOOL STEEL

MISCELLANEOUS SHOP TOOLS

MADE IN CANADA

ARMSTRONG WHITWORTH
OF CANADA, LIMITED

Head Office :
298-300 St. James Street,
Montreal

Works :
Longueuil, Que.

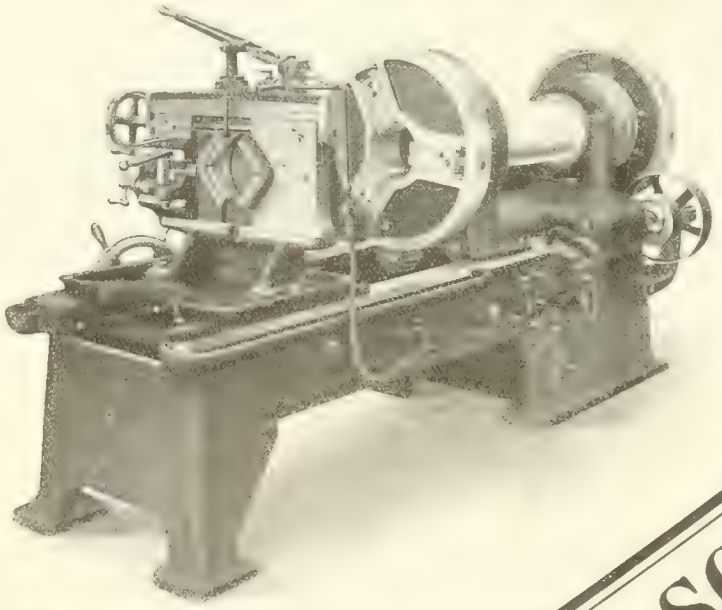
Branches :

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TORONTO

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HAMILTON

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OUR SPECIALTY
PIPE MACHINERY

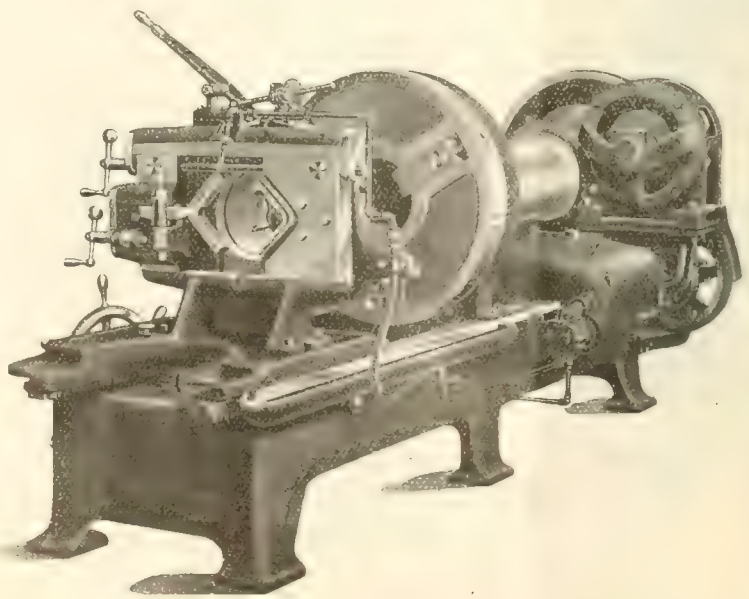
JOHN H. HALL & SONS, LIMITED

BRANTFORD, ONTARIO
MANUFACTURERS OF

Pipe Threading Machinery

No. 6 Belt Drive
Capacity 1 ¼ to 6"
Built to
Last

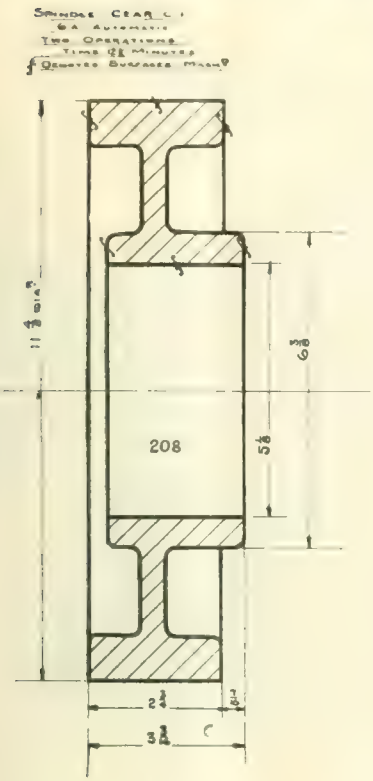
All
Sizes
Pipe Machines
Nipple Machines
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No. 8 Motor Drive
Capacity 2½ to 8"

Write for new
Descriptive Bulletins
Just Issued

P. & J. Automatics At Your Service



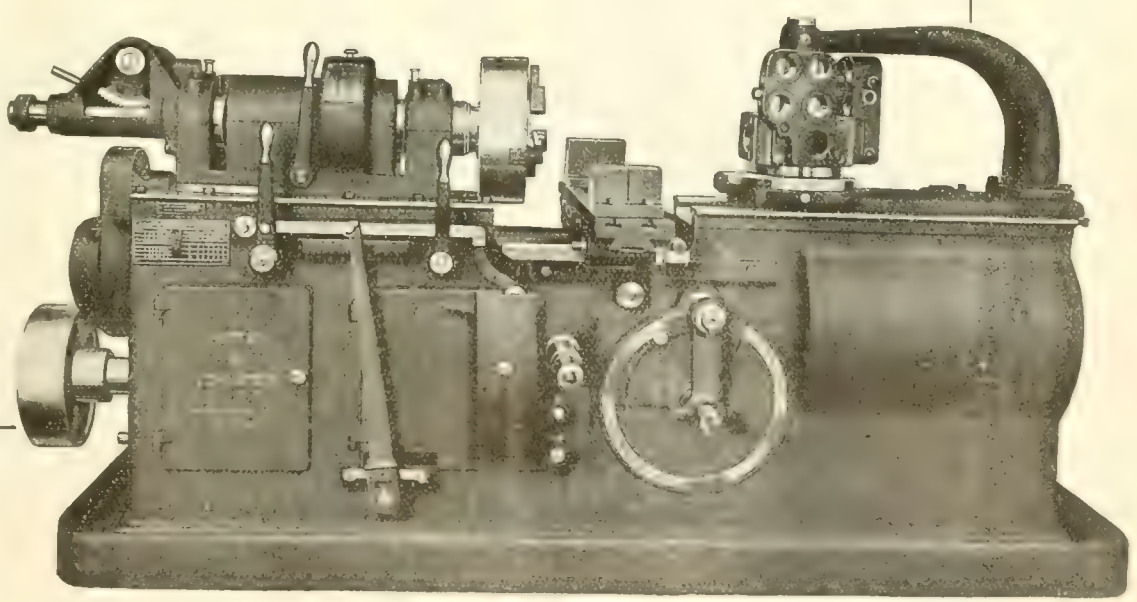
WHETHER you are making gears or flywheels or contemplating doing so, the proposition should look good to you.

The part illustrated is a gear blank and was finished on the Potter & Johnston Manufacturing Automatic Chucking and Turning Machines in two chucking operations.

We could give you the time on this job, but would rather give you figures on some of your own parts.

Send them along.

Bulletin 41



Canadian Offices: POTTER & JOHNSTON MACHINE CO.

ROELOFSON MACHINE & TOOL CO., LIMITED

Head Office: 1501 Royal Bank Building, Toronto, Canada

Works and Warehouse: Galt, Ont., Canada

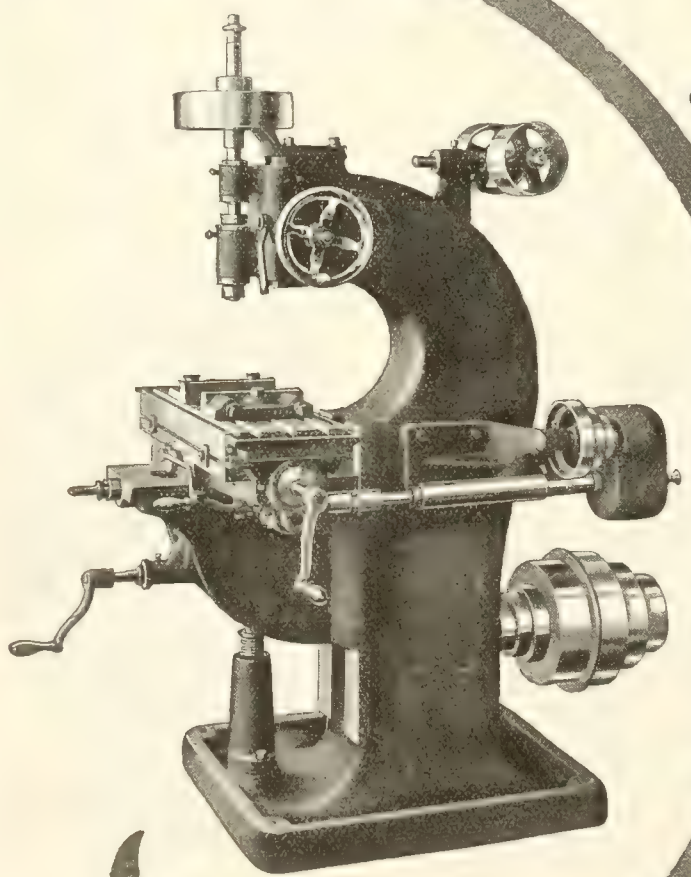
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BRISTOOL

Bristol Vertical Milling Machine

A Tool of Large Capacity





Ball Bearings are used at the most important points making it a free running tool, which, combined with its being a belt-driven machine, makes it capable of turning out work on which an extra smooth finish is desired.

The longitudinal table feed is controlled by the gear change box which gives six different feeds for each change of spindle speed. A stop to gauge with micrometer adjustment is used on the head to regulate the depth of cuts.

Learn all about its production capacity.

Write for bulletin giving fullest particulars.

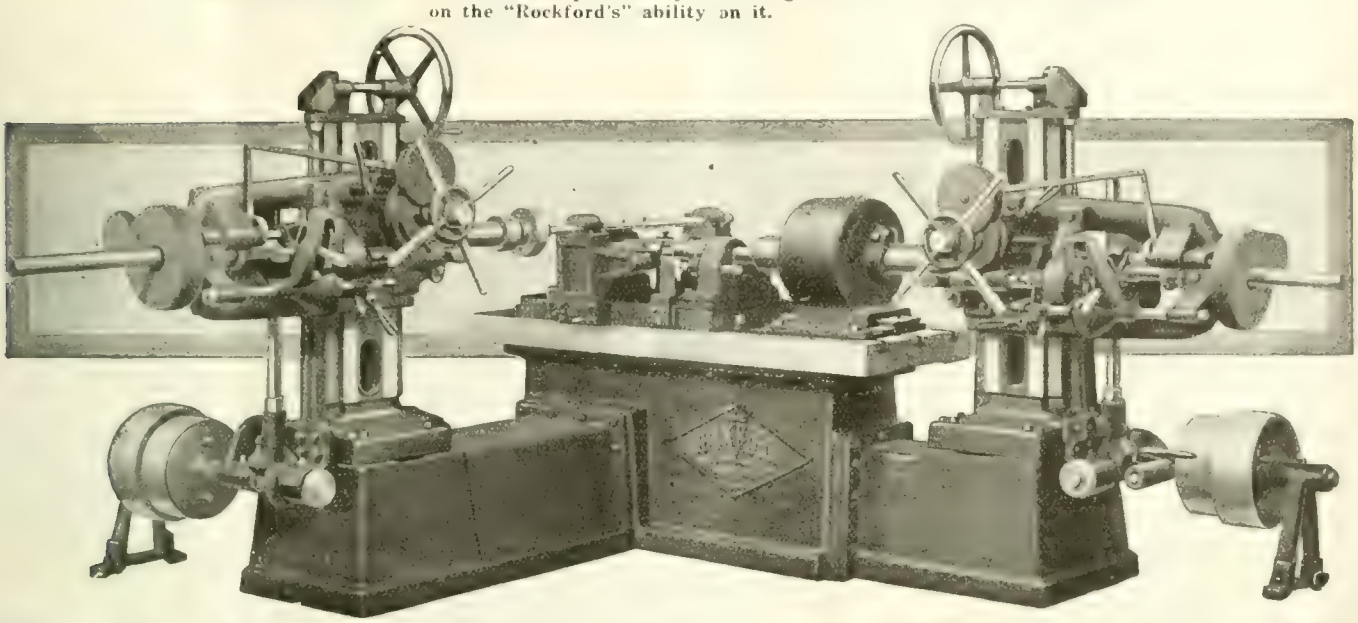
BRISTOL MACHINE TOOL CO.
SUCCESSORS TO C. G. GARRIGUS MACH. CO.
BRISTOL, CONN.

Rockford Horizontal Boring Machine

For Automobiler Manufacture

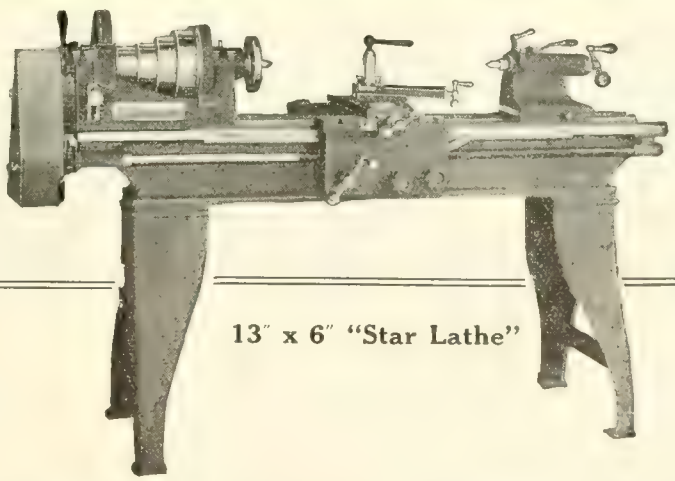
This tool is unusually rapid and accurate in the boring of crank cases, transmission cases and rear axles. Has two heads at right angles to each other. Spindles bore longitudinal and cross holes in work simultaneously.

Send us blue prints of your boring work and we will give you figures on the "Rockford's" ability on it.



The Rockford Drilling Machine Co., Rockford, Ill.

"STAR" Lathes



13″ x 6″ "Star Lathe"

The Tool that makes Garage Work and General Repair Work more Profitable

This is a remarkably sturdy lathe for its size, and its ease of operation, handiness, and accuracy all make it an invaluable tool. It does the work of larger and costly machines at a much lower cost.

Write for our new Circular

The Seneca Falls Mfg. Company, Inc.

366 W. Falls St., SENECA FALLS, N.Y.

STAR TRADE MARK REGISTERED

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STEEL *for*

Every Commercial Purpose

We are the only company in Canada producing steel ingots by the "HARMET" Liquid Process, a process that makes these ingots vastly superior to the ordinary kind, improving the physical properties and reducing the waste of ingot.

We can supply forgings of all shapes and sizes made of ordinary or "HARMET" Fluid Compressed Open-Hearth Steel on the Shortest Notice.

Nova Scotia Steel and Coal Co., Limited

Head Offices:
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Western Sales Offices:
Room 14 WindsorHotel
MONTREAL



Steel Ingots
by the
HARMET
Liquid Process

Swedish Steel & Importing Co., Limited

Montreal
New York
Toronto
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Direct representatives of foremost Swedish mills makers of

Tool Steels

ALLOY STEELS, BILLETS, BARS, DISCS, SHEETS, HIGH SPEED STEELS, DRILL RODS, DRAWN BARS, SEAMLESS TUBING, COLD ROLLED STRIP STEEL, WELDING WIRE, WROUGHT AND ROLLED IRON, PIG IRON, STEEL AND IRON ENDS, HOLLOW AND SOLID MINING DRILL STEEL.

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DOUBLE ESS

PROMPT SHIPMENTS from large stock

E S & M

ELECTRIC

Steel Castings

High Grade STEEL Castings
Of Every Description

Prompt Deliveries

Send us your drawings for estimates.

THE ELECTRIC STEEL AND METALS COMPANY, LIMITED
WELLAND ONTARIO



MacKINNON STEEL CO., LTD.

Engineers, Manufacturers and Erectors of Steel Structures

Industrial Bridges, Buildings, Towers, Smoke Flues and Stacks, Chutes, Coal Bins, Ore Bins, Tanks, Cranes, Engine Houses, Grain Elevators, Derricks.

Structural Steel and Steel Plate Work, and a combination of the two lines.

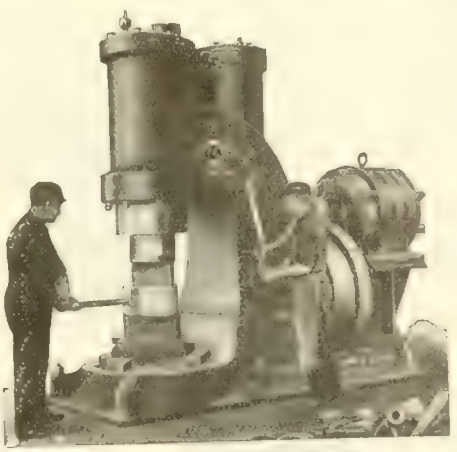
Prompt Deliveries Assured.

MacKINNON STEEL CO., LIMITED
Sherbrooke, Quebec
Montreal Office: 404 New Birks Building

The Nazel Air Hammer

(A Self-Contained Unit)

Noted for Its Blow and Control

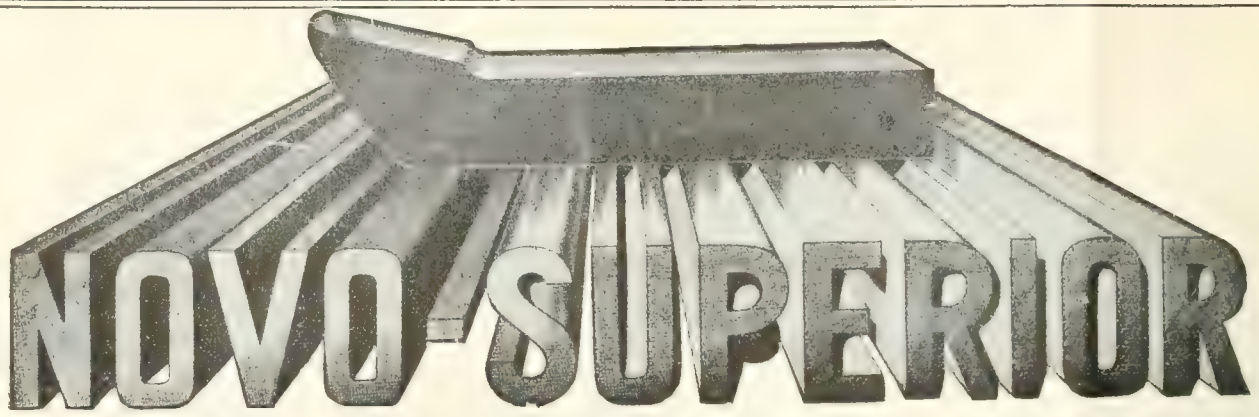


The Most Modern Reliable Power Driven Substitute for the Steam Hammer.

Built in 3 types, 6 sizes, arranged for belt or direct motor drive, with capacities up to 7" square for all manner of jobbing, manufacturing and certain classes of die forging. Write for catalogue.

Nazel Engineering & Machine Works
Dept. F., Philadelphia, Pa.

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HIGH SPEED STEEL

INTRA STEEL *GIBRALTAR STEEL*

Tool Steel for Every Purpose

SWEDISH LANCASHIRE IRON.

Twist Drills, Taps, Hack Saw Blades, Milling Cutters, Files, Etc.
Music Wire for Springs, Steel Balls
Cold Rolled Tool Steel in Strips and Sheets.

We call to your particular attention that we make a specialty of and solicit your inquiries for
Circular Saws—for wood and for hot or cold metal cutting
Machine Knives—for cutting wood, paper, tobacco, agricultural.

PILOT STEEL & TOOL COMPANY, Limited, 322 St. James St., MONTREAL

Sole Agents for JONAS & COLVER, LIMITED Novo and Continental Steel Works, Sheffield, Eng
H. BOKER & CO., Inc. New York, N.Y.

Dunbar

Springs *for* Every Use



We have been making springs of all kinds for 70 years. Let us advise you when in difficulty.

Tell us the purpose for which the spring is intended, and our experts will gladly co-operate to see that you get the design best suited to the purpose.

Dunbar Springs are thoroughly tested for **accuracy** and **quality**. Send us specifications, for estimates.

THE DUNBAR BROS. CO.
BRISTOL, CONN.



XXX
Genuine Arctic Metal

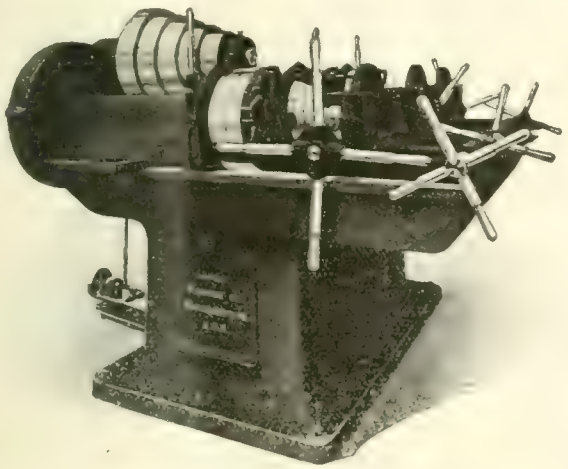
will give satisfactory results in the most troublesome bearings. Will last longer and save many times its cost in repairs. Will reduce your overhead expense.

Tallman Brass & Metal Limited
HAMILTON, ONT.

The Landis Die—A Sure Economy Investment

Do you cut threads? If so, are you using the Landis chaser which is tangentially disposed to the stock? This one principle alone makes the Landis entirely distinct from any other threading tool.

The Landis chaser does not rub or push off the thread; it cuts it and the results—more accurate threads, higher production, less consumption of power and less cost per thread.



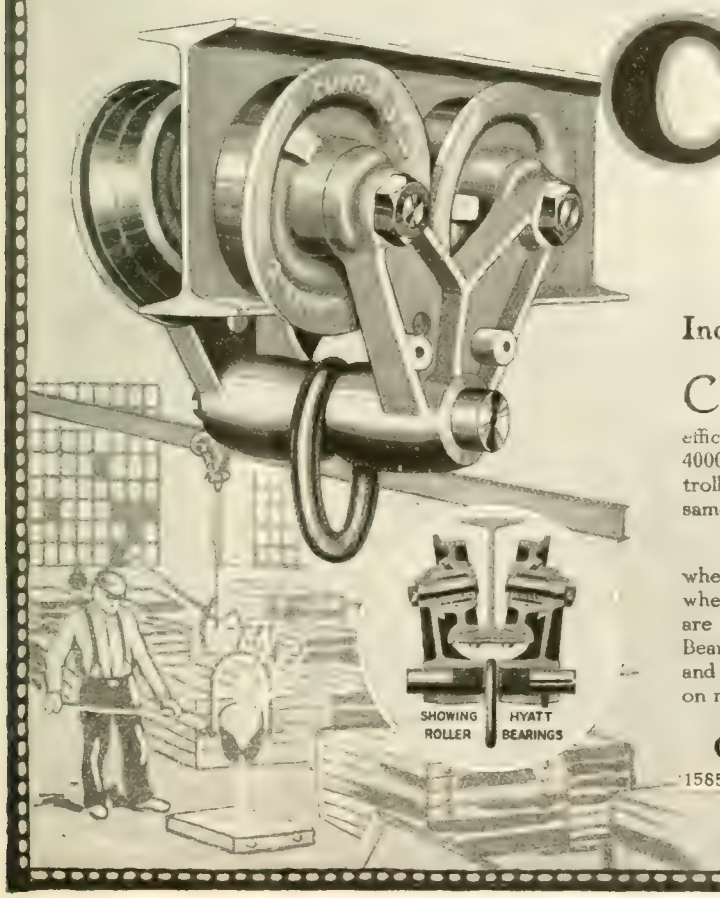
The chaser is four inches long. When grinding 1/32" is removed, thereby permitting the chaser to be ground from 90 to 120 times. Remember also, that to renew the chaser when dull, grind it only as annealing, hobbing and retempering are never necessary.

A Landis Head or Machine installed in your plant will convince you as it has many others, that it is the correct method of cutting threads, that it is the most productive, and that it is the most economical.

Write for our catalogue—it is free

LANDIS MACHINE COMPANY
WAYNESBORO, PA.

CURTIS TROLLEYS



Increase Production—Save Man-Power

CURTIS Single I-Beam Trolleys are being used by progressive firms demanding the highest operative efficiency. A Curtis Hyatt Roller-Bearing Trolley with a 4000-lb. load can be moved by a 50-lb. pull, while ordinary trolleys require nearly twice as much power to move the same weight.

Curtis Trolleys are constructed with large inclined wheels and self-equalizing steel side-frames—so that each wheel always bears its rightful proportion of the load. They are equipped with shock-absorbing Hyatt flexible Roller Bearings—which make the trolleys easy-starting, easy-rolling and long-lasting. Full information and descriptive literature on request.

CURTIS PNEUMATIC MACHINERY CO.
1585 Kienlen Avenue St. Louis, U. S. A.
Branch Office
532-A Hudson Terminal, New York City

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If You Want Production --

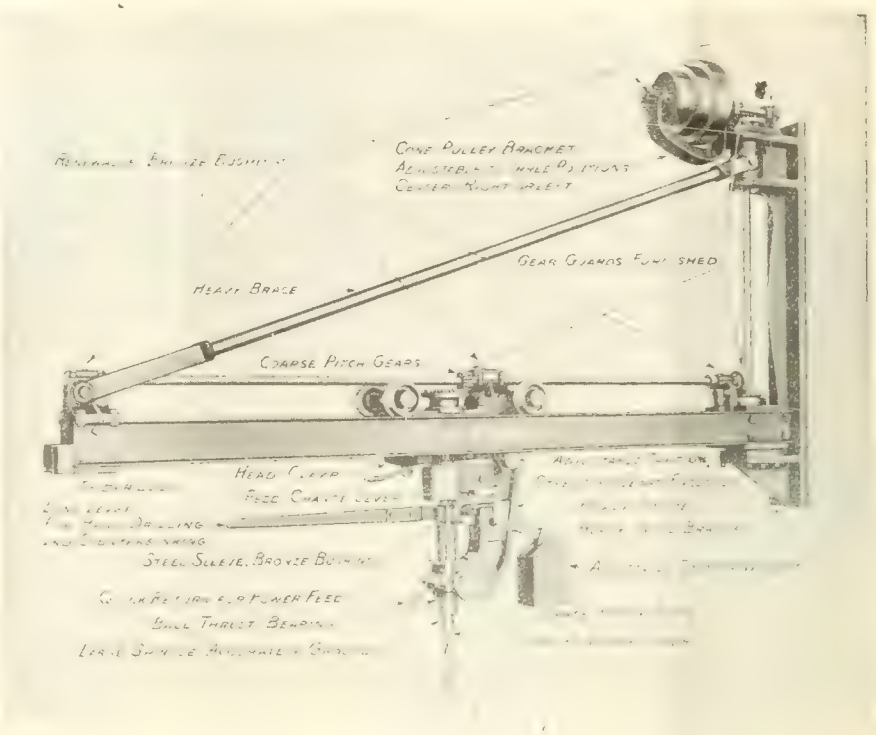
You can't do better than install this Wall Radial Drill in your plant. We'll say you won't have it in operation more than a month before you will begin to congratulate yourself on your judgment in adding this machine to your equipment. Materials and workmanship that you can depend upon to the limit are features of the construction, and our bulletin will give full details.

GET IT TO-DAY!

MADE IN FOUR STANDARD SIZES.

Rated size	Drills to centre of	Wall to end of arm
7 ft.	14 ft. circle	10 ft.
9 ft.	18 ft. circle	12 ft.
11 ft.	22 ft. circle	14 ft.
13 ft.	26 ft. circle	16 ft.

F.O.B. Boston, Mass.



LYND-FARQUHAR COMPANY

419-425 Atlantic Avenue Dept. B BOSTON, MASS.

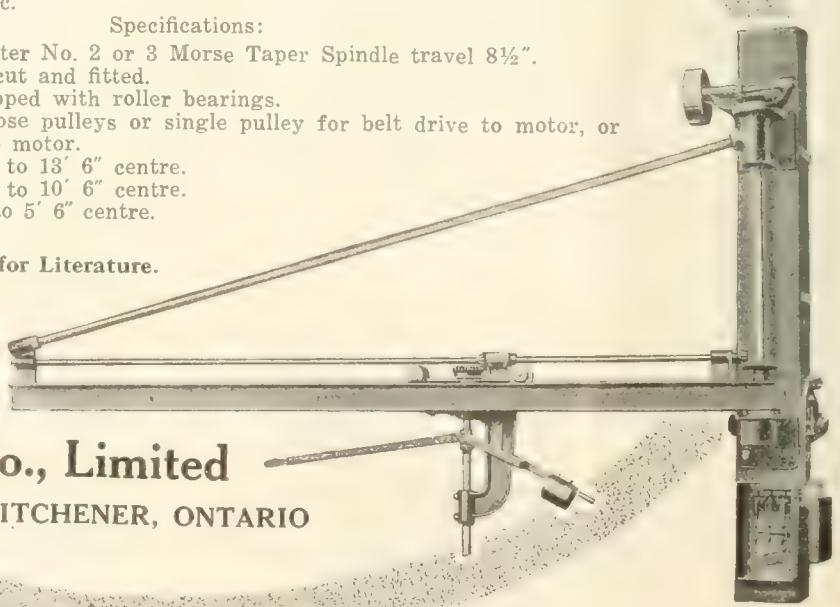
Built for Service

The Canadian Radial Drill is designed particularly for work in structural shops. For seaming and countersinking large surfaces such as structural shapes, boiler plates, long beams, etc.

Specifications:

Spindle 2 3/16" diameter No. 2 or 3 Morse Taper Spindle travel 8½".
All gears accurately cut and fitted.
Carriage wheels equipped with roller bearings.
14" x 14" tight and loose pulleys or single pulley for belt drive to motor, or direct connected to motor.
15 ft. Beam will drill to 13' 6" centre.
12 ft. Beam will drill to 10' 6" centre.
7 ft. Beam will drill to 5' 6" centre.

Write Dept. 16 for Literature.



Canadian Blower & Forge Co., Limited

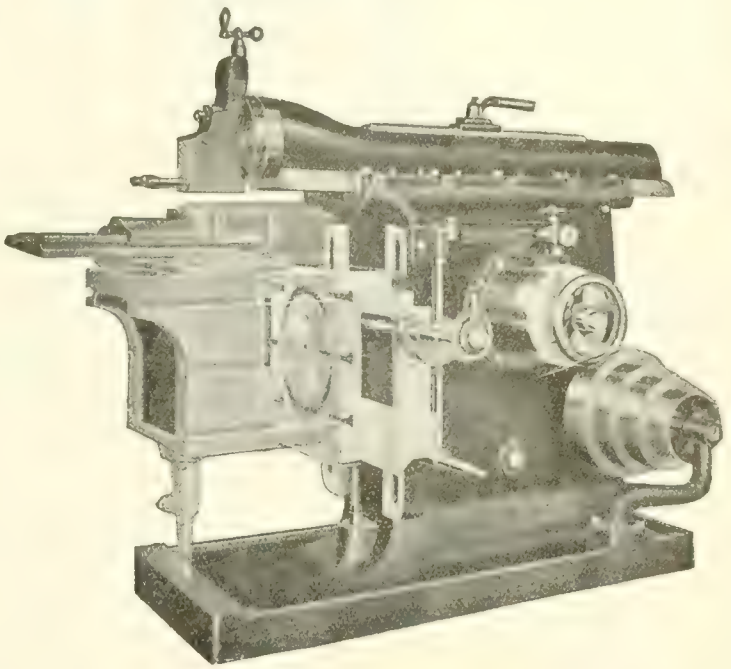
KITCHENER, ONTARIO

Milwaukee Shapers

Are needed in Up-to-date Canadian Shops

Milwaukee simplicity, power and accuracy play an important part in turning overhead expense into profitable production.

Milwaukee Back Geared Crank Shapers are built in 16-inch, 20-inch and 24-inch sizes.



MILWAUKEE SHAPER CO.

1029 Coldspring Ave.

Milwaukee, Wisconsin

WICKES' Heavy Duty Double Punch

Built for Real Service



We also manufacture High Grade Horizontal and Vertical Rolls, Angle Rolls, Single Punches, Shears, Spruce Cutters Radial Wall Drills or Counter-sinking Machines, Flanging Clamps and Heavy Duty Engine Lathes. *Ask for Catalogue.*

WICKES BROS., SAGINAW, MICH., U.S.A.

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ELECTRITE

High Speed Steel

SEVERAL factors combine to make this high-speed steel a triumph of the steel-maker's art; Electric Furnaces — entirely infallible, automatically regulated, delivering the same result time after time.

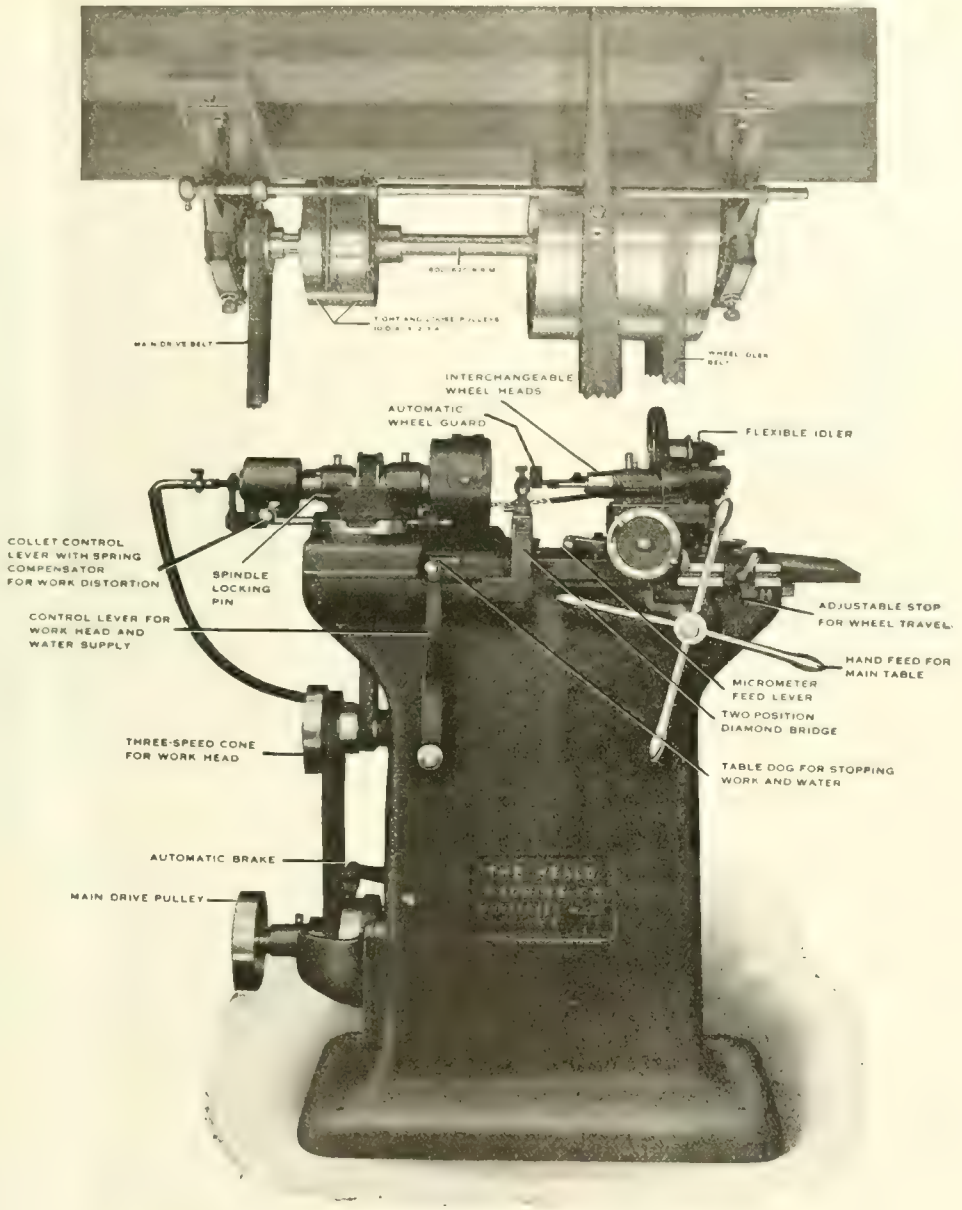
Uranium — This rare element, cousin to Radium, effects a profound change in the texture and quality of the steel.

Added to these, the constant care and skill of years of steel-making experience make the result of each melt a foregone conclusion.

Latrobe Electric Steel Co.
LATROBE, PENN.

URANIUM

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.



FOR GRINDING SMALL, SHORT WORK

The Heald No. 85 is a new, simple, productive machine for small, short work. It is designed so that movement of the pilot wheel to the right draws the wheel from the work and automatically puts on a brake, stopping the workhead and shutting off the water. It is furnished with a quick-acting collet with a capacity of $\frac{3}{8}''$ to $3''$ in diameter.

The table is provided with positive stops, enabling the operator to grind up to a shoulder. The machine is also equipped with a flexible idler, automatic wheel guard, water attachments and simple single countershaft.

THE HEALD MACHINE COMPANY

WORCESTER, MASS.

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Why use makeshifts?

WHY waste time and energy with makeshift devices for boring operations when Williams' "Agrippa" Adjustable Boring-Tool Posts offer convenience and efficiency developed to the nth power?

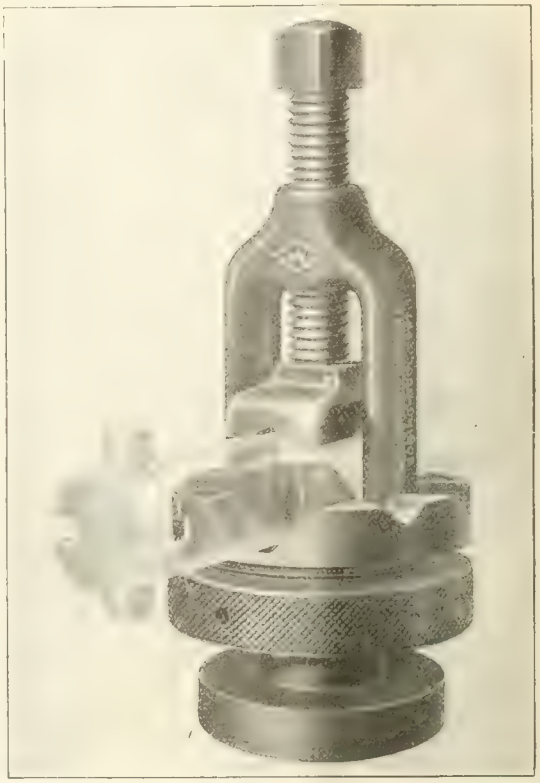
Each post accommodates a wide range of Bars, the height of which is readily adjusted; a turn of the Knurled Ring raises or lowers the base on which they rest. The whole device is instantly and rigidly locked by tightening the Set Screw.

Four sizes for ½ to 2¼" diameter Bars—furnished with or without Bars.

Ask for Machinists' Tools Booklet.

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"The Drop-Forging People"
45 Richards St., Brooklyn, N.Y.

The A. G. Low Co., Ltd.,
45 Pacific Ave., Saskatoon, Sask.
Agents for Manitoba, Alberta, Saskatchewan and British Columbia.



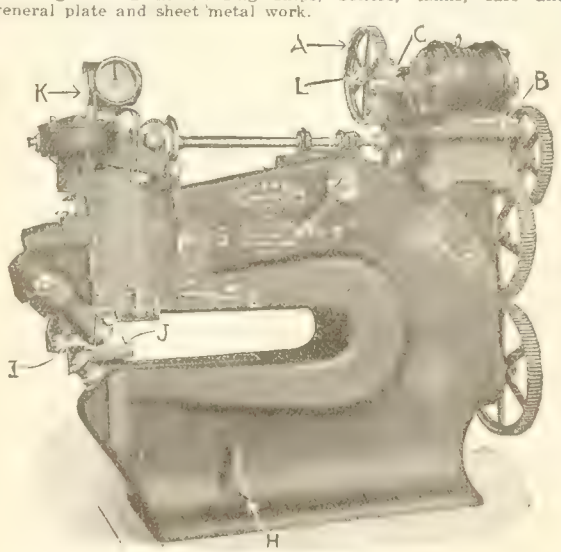
Williams' "Agrippa" Adjustable Boring-Tool Posts

"QUICKWORK"
Registered in U.S. and Foreign Countries.

ROTARY SHEARS

MADE IN 7 SIZES.

Cut all gauges of sheet and plate metal up to 1 inch thick in straight or irregular shapes and openings without cutting in from side of sheet. Leaves square, true edge that requires no finishing. Used in building ships, boilers, tanks, cars and general plate and sheet metal work.



Patented June 3rd 1913

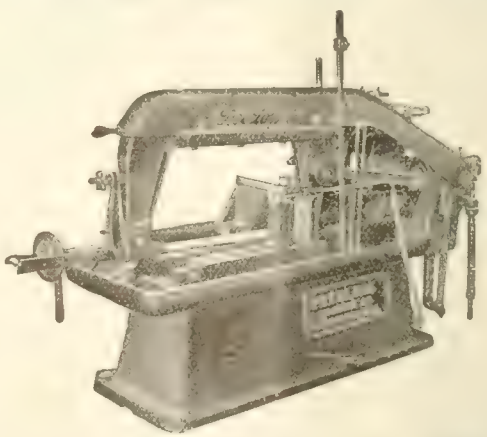
SAVES 50% TO 90%

Eliminates Oxyacetylene Cutting and Plate Planing.
Write for Catalogue No. 60.

THE QUICKWORK COMPANY, ST. MARYS, OHIO, U. S.A.
Cable address: "QUICKWORK."
Codes: W. U. and General

Peerless HIGH SPEED

The Standard Metal Saw of TO-DAY



While labor is demanding more and more, manufacturers are demanding machines of greater output. The "Peerless" meets that demand. It is the standard metal saw of TO-DAY.

With its rapid cut and various time-saving features, it easily increases production from 50 to 100 per cent. With its automatic feed, straight line pull, positive blade clamp and general rigidity, it gets the maximum results of which a blade is capable and reduces breakage to a minimum.

OUR SIX-SPEED GEAR BOX

(not shown in cut) further increases output and saves blades wherever soft steel or metals of varying degrees of hardness have to be cut. The "Peerless" is furnished either with or without this feature, also with or without motor.

A trial order at our risk and expense is convincing

PEERLESS MACHINE COMPANY
1607 RACINE STREET RACINE, WISCONSIN

If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

Individuality

RED-CUT SUPERIOR HIGH SPEED STEEL

A GREAT MAN wrote this: "I'm called away by particular business, but I leave my character behind me." And nobody had to guess whose character it was. Even if the familiar Red Cut label should disappear there would be no doubt as to the character of the steel that remained. More than ever would the quality shine forth in the results when it was worked. Adherence to the highest standard with an unvarying uniformity has placed a well merited reputation all its own on

"Red Cut Superior"

The Nationally Known--First Quality

HIGH SPEED STEEL

The Best For All Machine Work

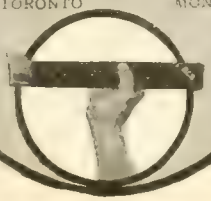
VANADIUM-ALLOYS STEEL CO.

General Offices : Pittsburgh, Pa.

Works : Latrobe, Pa.

BRANCH OFFICES

BUFFALO CHICAGO NEW YORK
BOSTON CINCINNATI PHILADELPHIA
CLEVELAND DETROIT PITTSBURGH
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Harris Heavy Pressure

The Babbitt Metal that's at the Front in Efficiency and Economy



Order a Box from our nearest Factory

Our Guarantee is Back of Every Pound of Babbitt Metal We Make

Manufactured by

The Canada Metal Company, Limited

TORONTO - CANADA
HAMILTON WINNIPEG
MONTREAL VANCOUVER

Perfect Riveting

Provided its cost is the lowest possible, riveting so well done that it can't be improved upon, is perfect riveting.

Boys on Grant Riveters accomplish two and three times as much perfect riveting as an equal number of men using ordinary machines.

With the

GRANT
ROTARY VIBRATING RIVETER



rivets placed close up to the shoulder of the work are as rapidly spun perfectly smooth as are rivets in easy-to-reach spots.

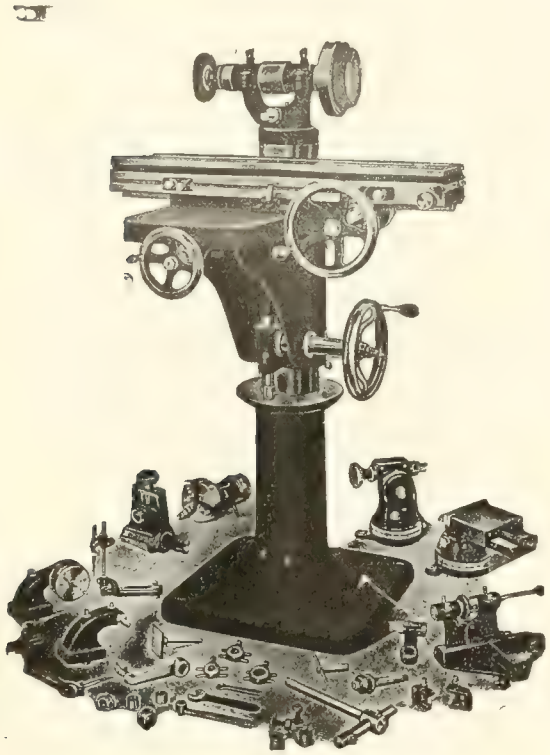
The Grant Mfg. and Machine Company

Holland Ave.

Bridgeport Conn.

Send for "Perfect Riveting"

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The Greenfield Universal Grinder

For General Tool Room Work

This grinder is furnished with attachments for grinding all sorts of milling cutters, reamers, counterbores, and other machine shop tools.

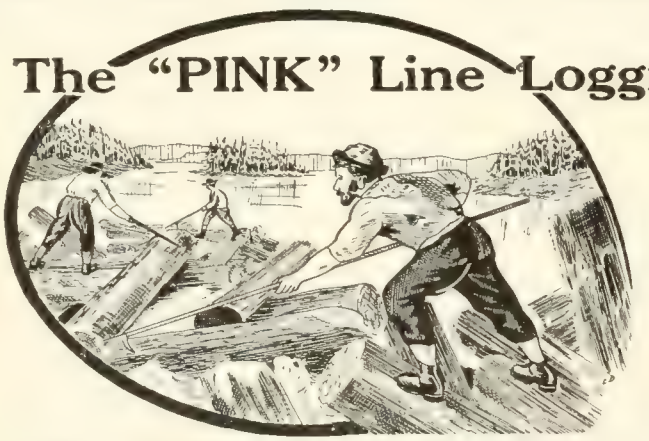
It is also suitable for cylindrical, internal and flat work which frequently turns up in the making of tools and jigs.

These attachments are all very simple in design and easily adjusted upon the machine, being graduated so that any desired angles can be at once obtained.

The whole machine is thoroughly well built, well finished, and will be found a dependable, convenient grinder.

Greenfield Machine Company,
GREENFIELD, MASS., U.S.A.

The "PINK" Line Logging Tools and Handles



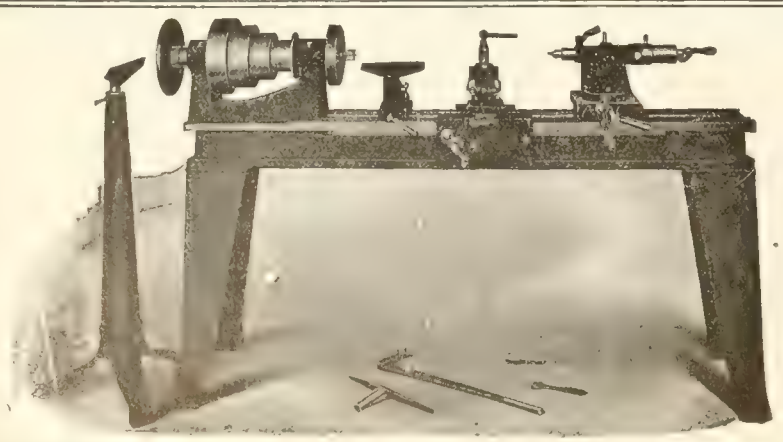
MADE-IN-CANADA Products---Headquarters for British Empire for all Lumbering Tools

In every lumber camp in Canada you'll find PINK'S famous lumbering tools. They are the favorites there and have won the esteem of all woodsmen through their superior merit. They are world-renowned and are extensively used in Australia, New Zealand and other countries where the lumbering industry thrives.

EXPORTERS TO EUROPE

We export the same good quality of lumbering tools that have made PINK'S TOOLS a by-word in the matter of good tools in all Canadian lumber camps. Enquiries cordially solicited.

Thomas Pink Co., Limited
PEMBROKE, ONT., CANADA



A Favorite—
Blount Pattern-makers' Lathe

FAST AND ACCURATE—Equipped with set over swivel tailstock and carriage, and outside face plate and tripod. Built in 16" swing with beds 6 or 8 feet in length. Spindle is made of high carbon steel, is hollow and fitted with Morse Taper and runs on self-oiling bronze bearings.

Our catalog gives a full description of this strong and highly efficient machine, also our other quality speed lathes and grinders. Give us your address.

J. G. BLOUNT COMPANY
EVERETT, MASS., U.S.A.



Thor Chipping, Calking and Beading Hammer

Thor **punch has helped put across many a job**

Time is one of the most important items involved in every contract job.

The speed with Thor Hammers, Drills and other Tools work has pulled many a contract through on time.

Write for our Thor Catalog No. 10

Independent Pneumatic Tool Company

334 St. James St. - Montreal

Thor

TORONTO
32 Front Street W.

WINNIPEG
123 Bannatyne Ave. E.

VANCOUVER
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MESTA MACHINE COMPANY
General Office and Works: Pittsburgh, Pa., U.S.A.

GAS AND STEAM ENGINES

for

Blast Furnaces, Rolling Mills
Power Plants
Gear Drives, Rope Drives, Condensers
Air Compressors Vacuum Pumps

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Blooming Mills
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Doubling Shears
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Rolling Mill Pinions and Gear Drives

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Steam Hydraulic Forging Presses
Steam Hydraulic Shears
Pickling Machines Metal Mixers
Iron and Steel Cut Gears
Iron and Steel Machine Molded Gears

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Large Engine Shafts—Piston Rods
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CASTINGS

Carbon Steel—Alloy Steel—Bronze
Air Furnace Iron Castings
Carbon and Alloy Steel Forging Ingots

Write for Bulletins

MESTA MACHINE CO.

Pittsburgh, Pa. U. S. A.

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DUNCAN STEWART & CO., LIMITED

LONDON ROAD IRON WORKS, GLASGOW

Established 1864

STEELWORKS PLANT

and

HYDRAULIC MACHINERY

Patent Rolling Mills. All types and sizes.

Bloom, Slab, Billet and Plate Shears, Steam Hydraulic and Electrically Driven.

Hot Saws.

Ingot Stripping Cranes.

Steam Hammers.

Tube Drawbacks.

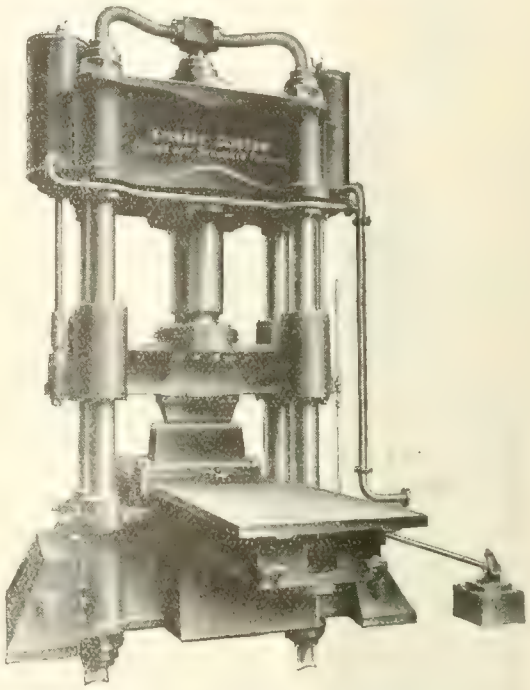
Patent High Speed. Steam Hydraulic Forging Presses, 150 to 12,000 tons.

Armour Bending Presses.

Troughing Presses.

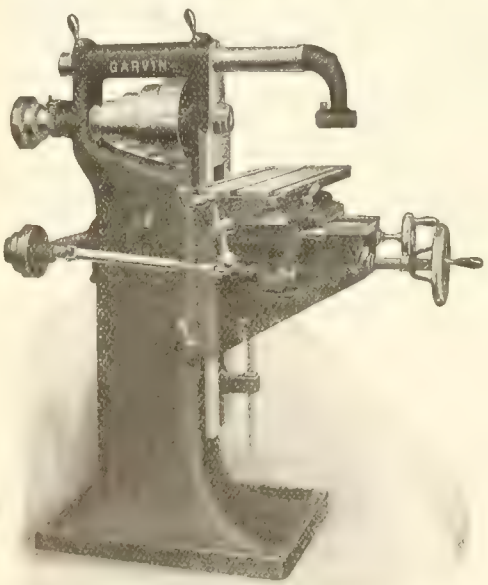
High Pressure Hydraulic Pumps.

Accumulators.



1200-Ton Steam Hydraulic Forging Press

GARVIN



No. 12—Plain Milling Machine Use Code Abrade

No.12 PLAIN MILLING MACHINE

ALL LIGHT MANUFACTURING

This machine is built especially strong and substantial for a tool of its capacity, and has many valuable features worthy of special mention. The slide is fitted with a quick pitch screw, giving one inch per turn. This combines the rigidity of a rack feed with the steadiness of the screw feed. The table has an oil pan all around it, with finished edges—automatic feed, trip and reverse—adjustable nut on the feed screw to take wear—the Feed Screw is hardened.

Adjustments 18 x 6 x 15 in.

For Further Information ASK YOUR DEALER OR WRITE US DIRECT

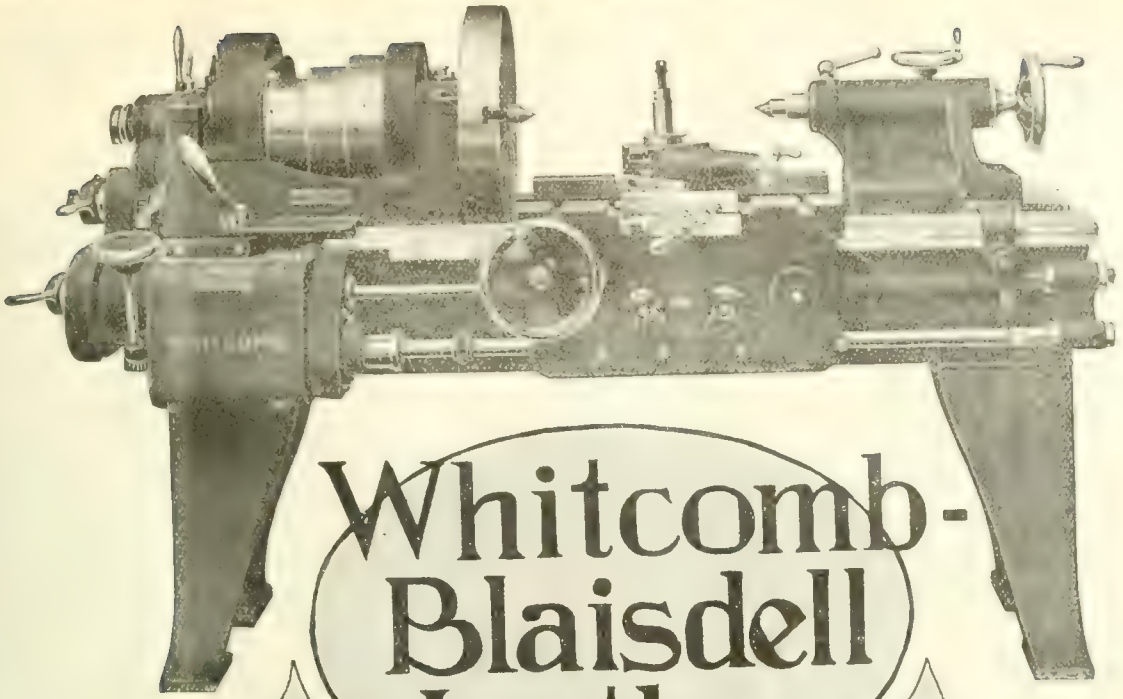
IMMEDIATE DELIVERIES

Send for Complete Catalog

Manufactured by

THE GARVIN MACHINE COMPANY

Spring and Varick Streets (*Visitors Welcome*) 50 Years New York City



Whitcomb-Blaisdell Lathes

POWERFUL, WELL-BALANCED MACHINES THAT ARE LIGHT-RUNNING AND ADAPTED TO ALL CLASSES OF **RAPID MANUFACTURING.**

Every feature of the W-B Lathe of to-day has been considered from the viewpoint of greatest utility. Materials used embody toughness and durability. Our tests must prove great wearing quality and strength before any material is selected.

The product of an organization that has for sixty years been distinguished for the superior design, workmanship and material of its product

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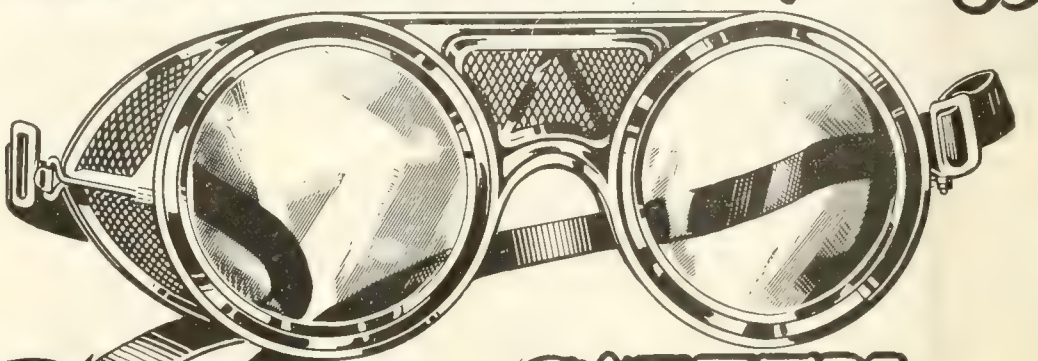
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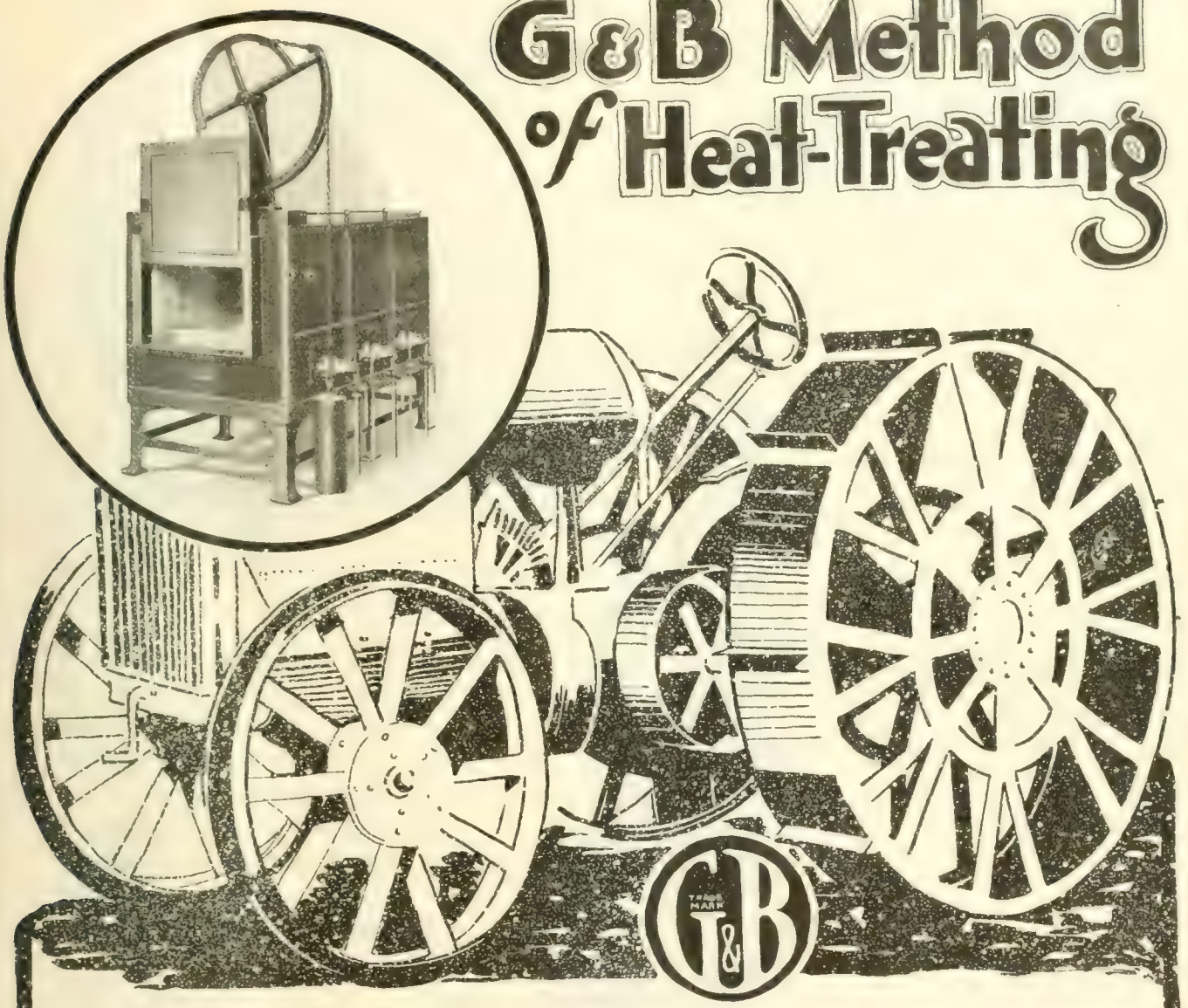
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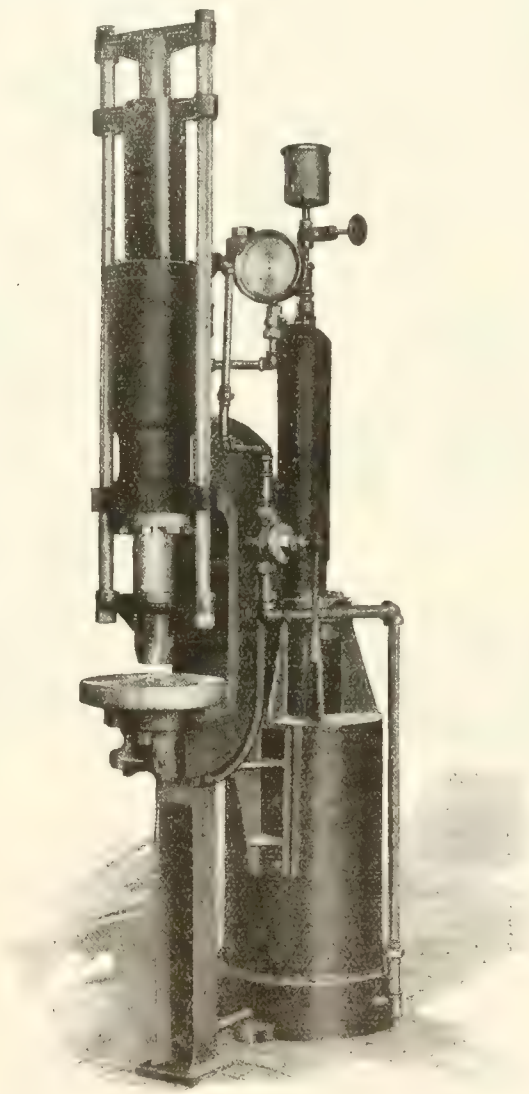
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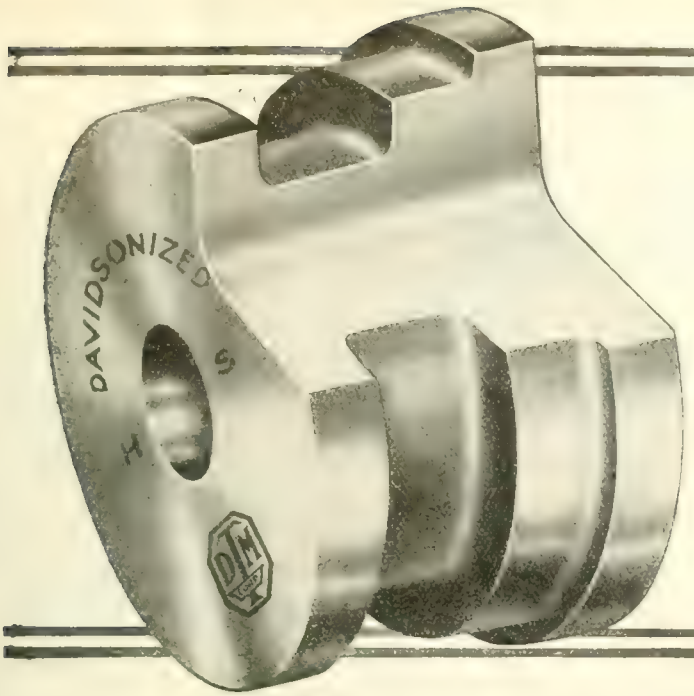
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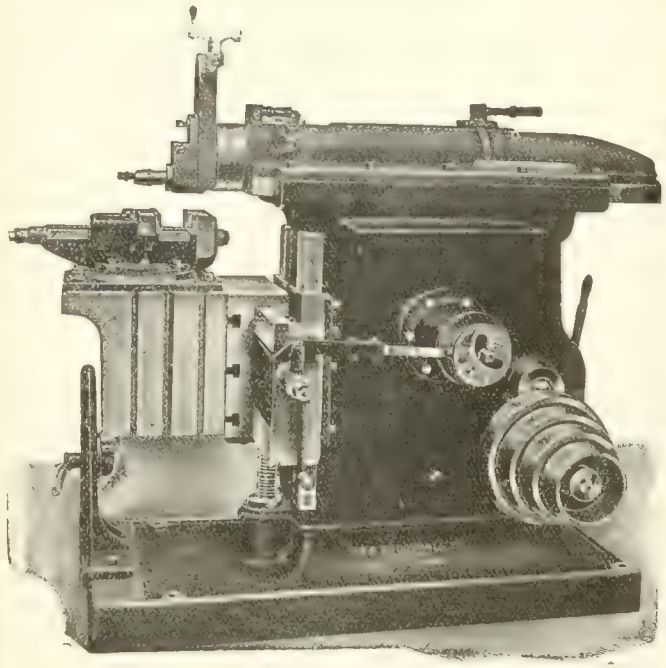
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An examination of the construction will reveal features that make for increased production, ease of operation and accuracy.

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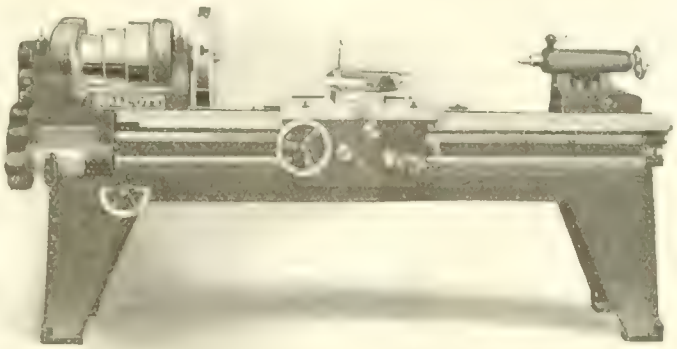
They are "different" because "They cut faster and wear longer."

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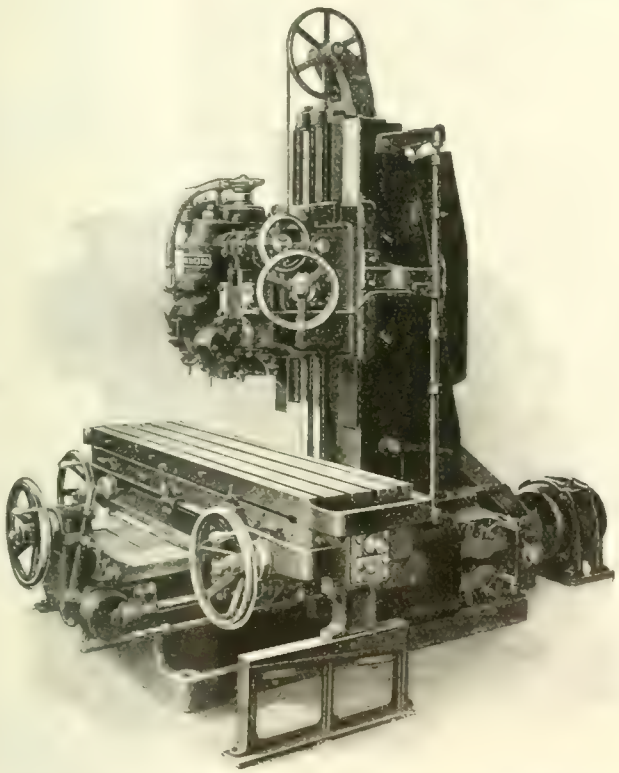
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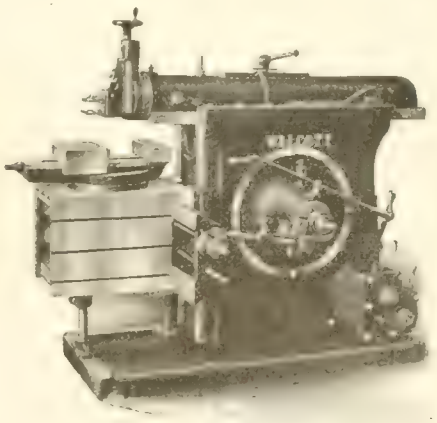
Walcott Lathe Co.

115 Calhoun St. Jackson, Mich.

Est. 1881

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WALCOTT SHAPER

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Notes On Grinding

NORTON COMPANY WORCESTER MASS

No. 52A

GETTING THE MOST OUT OF THE WHEEL.

DID YOU EVER stop to reason why one operator on the same work, same machine and same wheel, gets 100 pieces ground with one truing while another only does 50? That is just where the art and knack creep into grinding. You cannot tell any one how to obtain such results; that must come with experience. It is possible, however, to point out a number of little things which, if observed, will form a foundation on which to build such experience. The following is an interesting instance demonstrating this fact.

Noticing that an operator in an automobile factory handled the wrist pins which he was grinding in a very unusual way, a Norton engineer who was present inquired how many he was doing in one hour. When he replied, "Twenty-five," it was evident that something was wrong because on this operation it should be possible to do at least forty or fifty per hour. The operator went a little further than this and stated: "I am in trouble and need help. You know the price on this job is $1.35 per hundred. The boss says I ought to make $5 per day. The company want more parts and I need the money, but I can't make out."

The piece being ground was about 6" long. The operator fed a 1½" face wheel into the work five times, stepping over each time for roughing down the pin. Then when he was ready to finish he stroked the work, using the table power travel. The wheel, he claimed, wore away too rapidly, although it was a 36-K wheel and should be efficient for that particular job. It so happened that he was running the wheel on the fastest work speed and was not using the automatic wheel feed but rather fed the wheel in by hand, and in so feeding did it very irregularly.

It was a simple matter to fix this fellow up by changing the work speed so that it was considerably slower, which had the effect of making the wheel act harder. By stroking the work all the time the wheel cut more uniformly, and secondly lasted longer. Using the automatic wheel feed provided time for him to prepare another piece of work for the grinding machine, placing it on the arbor, and also made the wheel stand up better, not suffering from the abuse of feeding first .001" and then .010". Later in the day the engineer returned and the operator greeted him with a broad grin: "I did 78 pieces since you left." That was at the rate of forty per hour, removing .025" stock to .001" limit, the material being case hardened steel.

This is only one of the many illustrations that could be recorded from actual experiences where the principles of grinding were not thoroughly understood. So many times the wheel is blamed for something which, if properly used, would never cause trouble. Wheel action is a very delicate element in grinding, and responds very rapidly to changes in speeds of either work or wheel, changes in radial depth of cut or arc of contact of wheel with work. A great many fail to attain high efficiency in wheel service because these laws are not observed.

If you suspect that there is something wrong with the production results you are obtaining, why not write to our Sales Engineering department and put the problem up to them? They will be glad to advise you from experience gained in their many years of experimenting with work perhaps quite similar to yours.

NORTON COMPANY.

Canadian Agents: The Canadian Fairbanks-Morse Co., Ltd., Montreal, Toronto, Ottawa, St. John, N.B., Winnipeg, Calgary, Saskatoon, Vancouver, Victoria. F. H. Andrews & Son, Quebec Que.

Grinding Wheel Plants, Worcester, Mass.

Electric Furnace Plants		New York Store	Chicago Store
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This will be the result of taking small milling jobs from your big millers and putting them up to



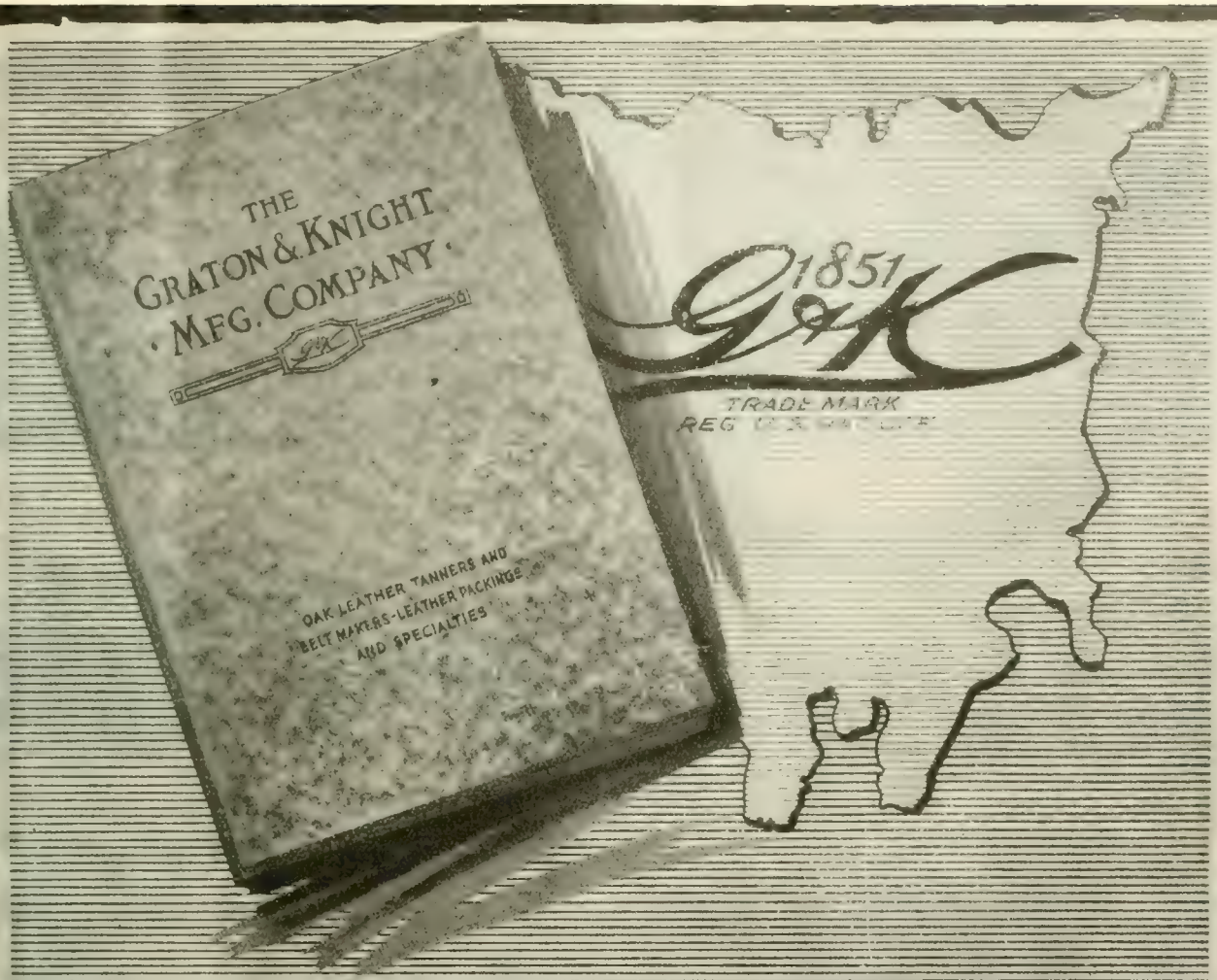
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Belt users find this book invaluable. Write for a copy.

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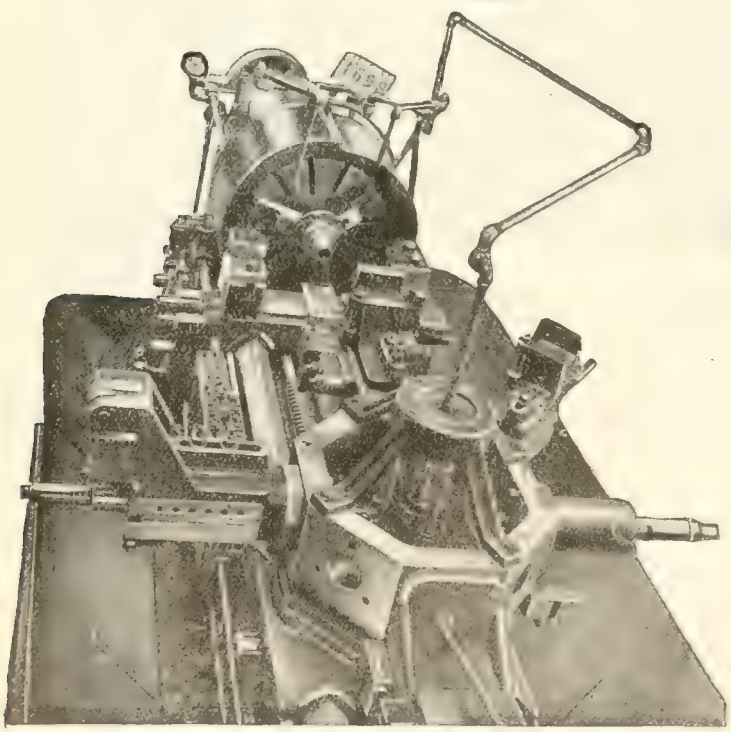
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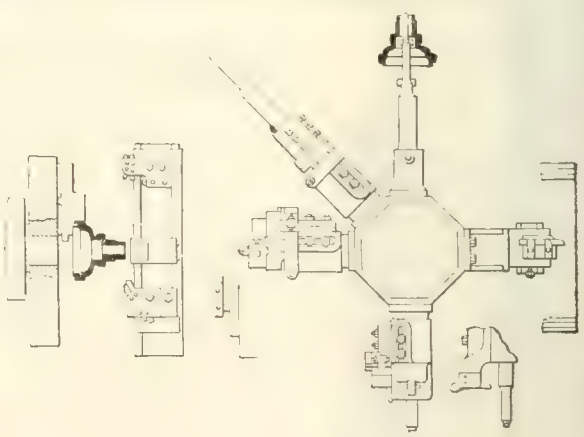
Sample of Gis



This picture shows first operation

From the Gisholt

These pages are worthy of study. They illustrate the way in which Gisholt engineers will help you solve your manufacturing problems.



Showing tooling set-up.

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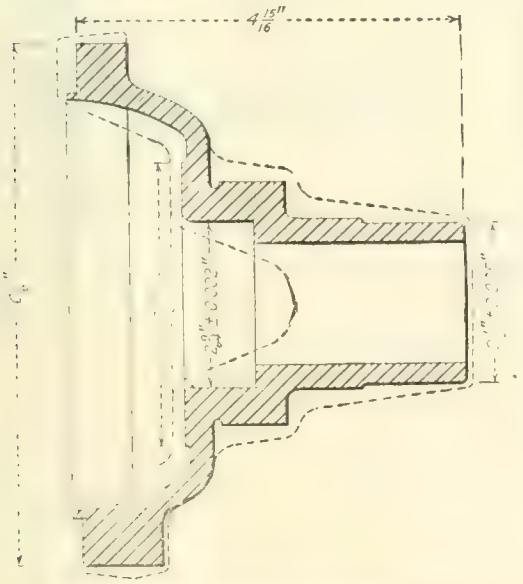
If what you need is not advertised, consult our Buyers' Directory and write advertisers listed under proper heading.

HOLT

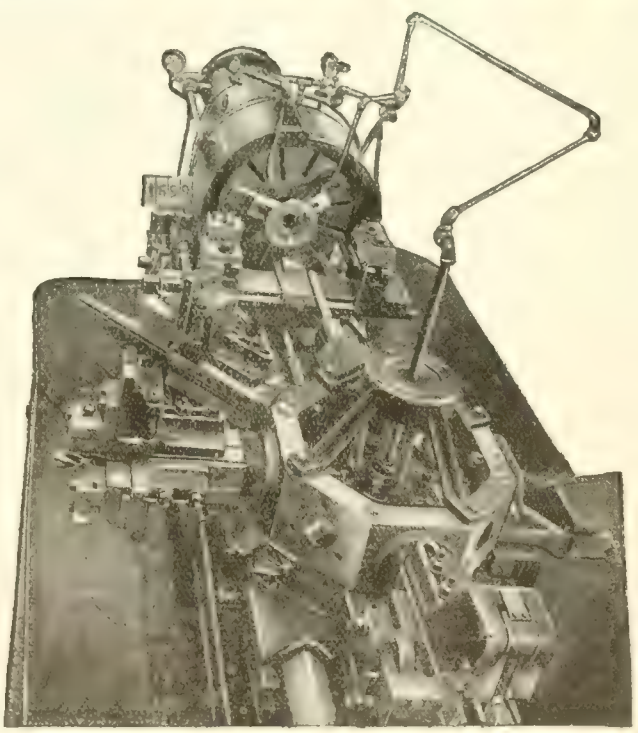
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Differential casing from drop forging. Floor to floor time for both operations 33 minutes.



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This picture shows second operation. Both of these operations are performed on one machine during one revolution of the turret

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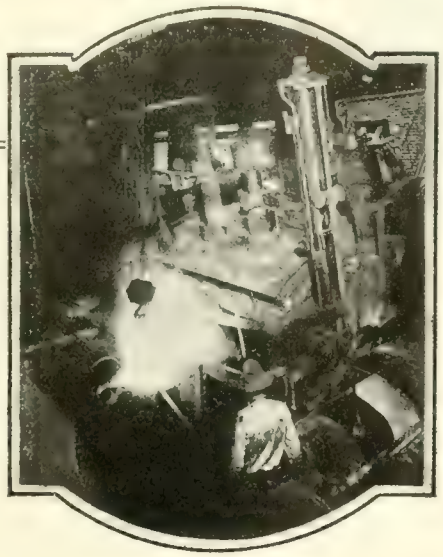
Vol. XXI. No. 23 December 4, 1919

Types of Greaves-Etchells Electric Furnaces

A Percentage of the Total Heat Generated is Released in the Hearth of the Furnace

By W. F. Sutherland

Long Refractory Life, Stirring of Bath and Good Power Control Are Thus Accomplished



THE electric furnace is a metallurgical instrument in which any desired temperature up to the point of fusing of the best refractories obtainable can be attained and perfectly controlled. At these high temperatures chemical reactions take place more rapidly than in other processes and the most refractory metals and alloys can be reduced to fluidity. The flexibility of the electric furnace also gives it a great advantage over former processes and the superior quality of the product is very marked.

Scrap containing valuable alloying metals, such as nickel, chromium, tungsten, vanadium, etc., can be melted without the loss of these elements and works that have sold their steel swarf and scrap, cast iron borings, etc., at very nominal prices are installing electric furnaces and making their own castings formerly purchased. The charge can be made up entirely of scrap and turnings, no expensive raw materials being necessary except additional alloying metals if these are desired.

Steel from the electric furnace is finished off under a reducing atmosphere of carbon monoxide and a slag out of which metallic oxides have been reduced and is therefore singularly free from blow-holes and occluded gases when properly cast. This is due to the elimination of the gases that molten steel usually holds in solution; and the ease with which the steel can be poured into small and intricate castings, flowing smoothly like cream and sitting perfectly quiet in the moulds is largely due to its purity.

An electric arc furnace for steel making usually consists of a steel tank lined inside with refractory materials and fitted with working doors and tilting arrangements for teeming. Carbon or graphite electrodes of a suitable section are inserted through the roof or walls and may be regulated either by hand or automatic control. A high tension supply is brought into a transformer house adjoining the furnace and transformed down to a low pressure alternating current for operating it.

The method by which the heat is introduced into the steel bath of the furnace is of much importance. The heat is generated in most types of furnaces by means of electric arcs formed between the electrodes themselves or between the electrodes and the metal bath. A disadvantage of this type of furnace is that the heat is applied at the top of the charge only, which is superheated, while the bottom may be comparatively cold, causing serious metallurgical difficulties. Several attempts have been made to overcome this objection by the use of conductive hearths and bottom electrodes, but no real improvement was achieved until the invention of the "Greaves-Etchells" system by two Sheffield engineers, H. A. Greaves and H. Etchells, B. Met., who had the advantage of operating both electrically and mechanically the leading types of furnaces installed in Great Britain.

It was the aim of the inventors to produce a furnace which would fulfil the following conditions:

(A) A system which would be applicable to any polyphase supply system, especially those of the higher commercial frequencies and which would maintain a steadier phase balance and higher power factor than furnaces then existing.

(B) The generation of heat in such a manner that it was applied as directly as possible to the metal in the furnace and did not superheat the slag and various portions of the lining more than was essential for maintaining the metallurgical conditions necessary for refining steel.

(C) Rapid melting and uniform heating of the charge.

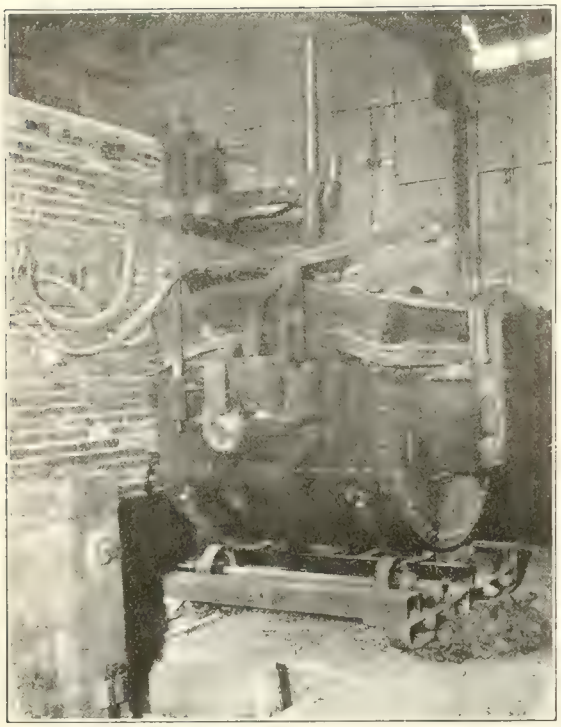
(D) Automatic circulation of the metal—giving uniform quality of steel—and avoiding the constant use of stirrers or rabbling.

(E) The construction of a furnace, which should be free from obvious mechanical defects so common in the earlier days of the electric furnace industry.

Construction of Furnace Hearth

In order to obtain an even temperature throughout the bath of molten metal in the electric furnace, it was realized that heat must be applied below as well as above the bath. Two phases of a three-phase low tension supply are connected to their respective upper graphite or carbon electrodes, while the third phase is connected to the bottom of the hearth. The current flowing through the hearth generates a considerable amount of heat immediately below the liquid in the most efficient manner, while the electric arcs arranged immediately above the bath maintain the slag and surface at the proper temperature.

The hearth lining is of special construction to achieve the above result and is never less than 20 in. thick. It is constructed mainly of dolomite, magnesite and other materials in such a manner that the electrical resistance is



ANOTHER INSTALLATION.

high at the inside of the bath and decreases rapidly to a negligible quantity at the outside. The outside of the furnace bottom remains cold, little or no heat being lost in this direction.

The importance of this special construction may well be emphasized, for if the hearth were constructed of a refractory material of uniform resistance at normal temperature when the inside face became heated by contact with the molten metal, its resistance would be materially lowered and most of the resistance would remain concentrated in the outer face. This would result in a material loss of heat since the heat generated by the passage of an electric current varies as the resistance.

Other furnaces with bottom electrodes are, of course, constructed, but in none of them does the hearth itself act as an electrical resister contributing heat to the underside of the liquid metal.

The results of the application of bottom heat are well worth noting. In the first place, liquid steel always tends to be sluggishly in the hearth of a furnace and if heat is only applied by the use of electric arcs above the steel, the slag and upper layers of metal become greatly superheated over the metal lying in contact with the lining. In order to get the metal at the bottom of the bath to the necessary degree of fluidity, it is necessary to overheat the slag and upper layers of metal to such an extent that great erosion takes place on the lining of the furnace at the slag line. A considerable amount of heat is also radiated upwards from the slag, quickly destroying the roof and upper walls of the furnace.

The use of bottom heating obviates these evils, through the reduction in the amount of energy liberated over the bath by the arcs and, of more importance, by the uniformity in temperature of the metal which results. The metal at the bottom of the furnace tends to reach a higher temperature than the average of the top of the bath and following the same laws on which all hot water radiating systems work the hot metal rises and the cold metal descends. This slow circulation takes place positively and continuously during the whole course of heat.

In furnaces not embodying this feature of bottom heating, it is stated that the lining in the vicinity of the electric arc tends to be damaged to a much greater extent than elsewhere. The enormous concentration of energy in the electric arc greatly superheats the adjacent slag and metal of the bath with the result above noted. By means of the slow circulation of the metal due to bottom heating, the heat supplied in the region of the arc is quickly absorbed by the moving streams of metal and distributed uniformly over the hearth of the furnace. Bottom heating, therefore, operates in the same manner as mechanically stirring or rabbling

This feature also works to advantage in the manufacture of alloy steels. If lumps of cold metal or additions of alloys so difficult to melt as ferro-chrome or ferro-tungsten are thrown into the bath they will be dissolved at a reasonable rate and will soon be distributed throughout the liquid bath. Where no bottom heating is available much stirring has to be done in order to effect a complete distribution of the alloying materials and labor trouble is sometimes encountered, owing to the arduous nature of the work required from the melters. Another advantage of this slow circulation of the metal from the bottom of the furnace is seen in the rapid refining which is possible, as all parts of the molten bath are automatically brought into contact with the refining slags.

Electrical Features

The use of a three-phase current, two phases of which are connected to the electrodes, while the third is connected to the conducting hearth, introduces a variation in transformer connections which is of some interest and which results also in excellent operating characteristics.

This system of connection at first sight would appear to cause an out-of-balance load on the primary supply, but the system of transformer ratios, which is carefully calculated, is arranged so as to give a perfect balance when the upper electrodes are in equal adjustment. The three secondary transformer windings are arranged in star, while the primaries are in delta. The hearth is connected to ground as well as to one of the transformer windings, the neutral point of the transformer windings thus being above earth potential.

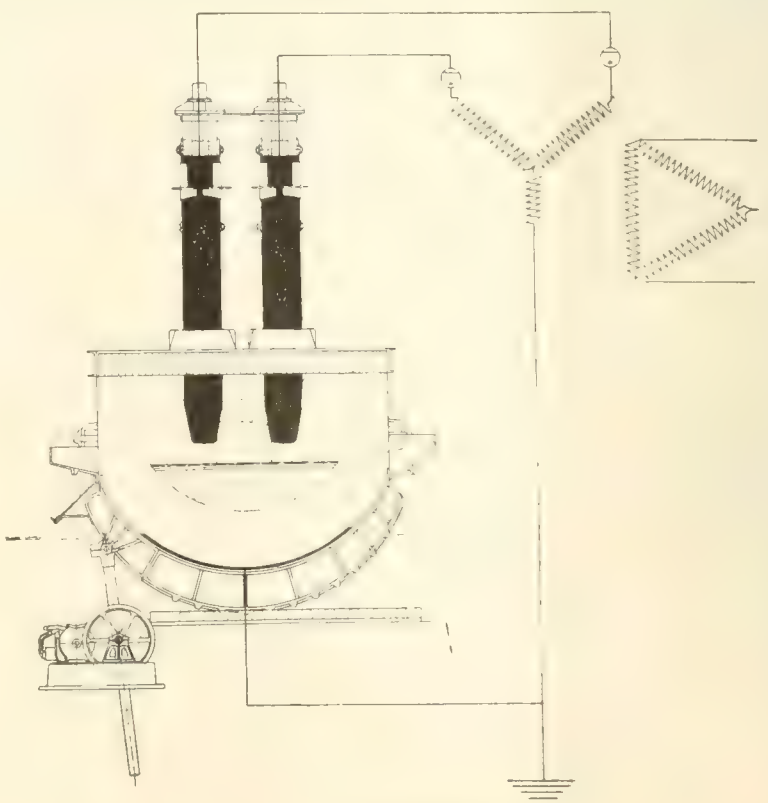
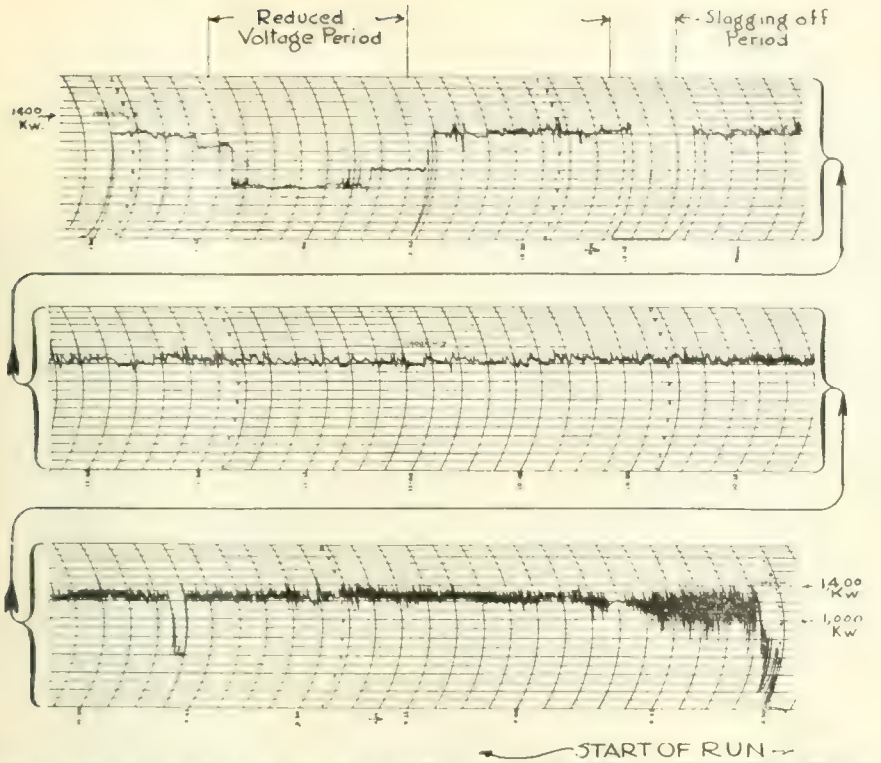


DIAGRAM OF CONNECTIONS



THE ABOVE CHART WAS TAKEN ON A 6-TON GREAVES-ETCHELLS FURNACE WITH AN ESTERLINE WATTMETER AFTER A SHUT DOWN OF 18 HOURS, USING COLD, MISCELLANEOUS SCRAP, AND REFINING UNDER TWO SLAGS. NOTE THE TIME INTERVALS AND THE ABSENCE OF SUSTAINED PEAKS

The two electrode arrangement is used in furnaces up to three ton capacity. Above this size four electrodes are employed. This arrangement of the electrical equipment is equivalent to two individual and distinct circuits, such as are employed in the smaller furnaces. Each pair of electrodes with their respective transformer connections can be switched up individually, thus enabling one pair to be kept in operation, while adjustments are being made on the other pair. The total overload of the furnace under short circuit conditions is also considerably limited by this arrangement, because each half of the furnace trips its particular switch when its own pair of electrodes become overloaded, thus halving the percentage overload, which will be necessary to trip the whole adjustment.

The electrical connections possess several other interesting operating features. Close regulation of the load under short conditions is obtained without the use of excessive reactance in the transformers or externally in the form of reactance coils. In this system it is impossible for an electrical circuit to be closed without traversing the secondary windings of two transformers in series. These transformers each have a different phase angle and the short circuit current is opposed by two magnetic fields, neither of which is in phase with it. This automatically lowers the power factor as long as the short circuit persists and is thus equivalent to the momentary introduction of reactance. A strong buffer effect is thus obtained and the fact that there is always a permanent resistance in the path of the current through the hearth also limits the effect of short circuits.

The combination of these factors provides a very effective means of protecting equipment and supply system from the stresses resulting from short circuit conditions, while allowing a high power factor to be obtained on normal load. The sudden overload due to short circuit bumps seldom exceeds 25 per cent. of the load at which the furnace is normally running, as compared with very much higher figures on other types of furnace.

With this system it is also impossible to have any one phase or primary supply unloaded.

The operation of each electrode is independent of all others. The current from any one in passing through the arc completes its circuit through the liquid metal and through the lining of the furnace. It is thus not necessary or possible for the circuit to be completed through another electrode and complete individual control is obtained. This of one electrode dipping into the bath and upsetting its carbon content through the dissolving action of the steel on the tip of the electrode. This is important in the production of steel of accurate composition and it also prevents breakage of electrodes or mechanism when a cold charge is being melted.

The limitation of overloads effects a considerable economy in the cost of electrical equipment necessary.

The energy supplied to the furnace is regulated over a considerable range by raising or lowering the electrodes and this can be done by means of automatic regulators, of the Thury or Seede type, which maintain a current at a pre-determined figure or by means of the motors and controllers or by hand. Arrangements are also provided for varying the voltages across the arcs, in all except the smallest size, and the ratio of heat generated above and below the bath can be regulated over a wide range.

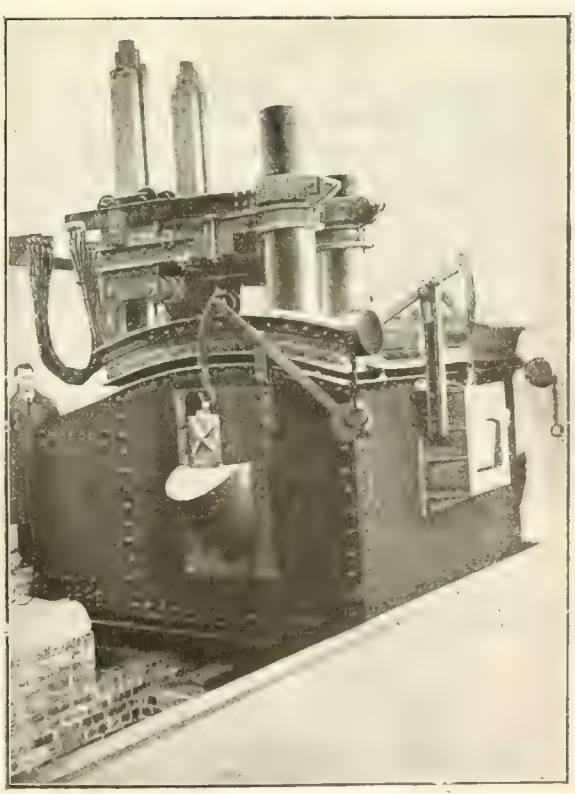
Power Factor and Load Curve

The power factor is high, owing to the elimination of unnecessary reactance. The operating power factor obtained in one plant as a result of over twelve months' running averaged during the melting down period between 85 and 88 per cent., and 92 to 95 per cent. was consistently maintained during refining.

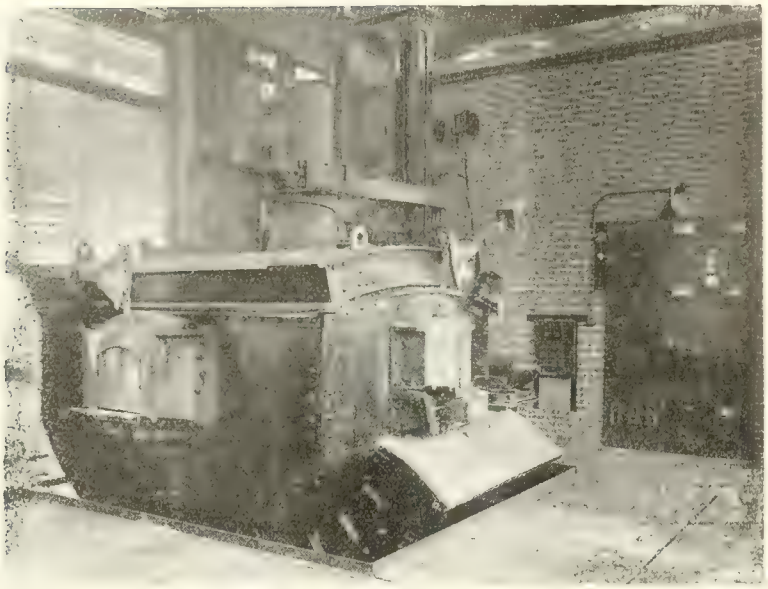
The remarkably even character of the load is well illustrated in the accompanying chart, which was taken on a 6-ton Greaves-Etchells furnace after a shut-down of 18 hours, using cold miscellaneous scrap and refining under two slags.

Mechanical Features

The furnace is of substantial con-



TYPE OF FURNACE.



THREE-TON GREAVES-ETCHELLS FURNACE.

struction and the design is such that ruggedness combined with strength is achieved. Furnaces up to 6,000 lbs. capacity are mounted on rockers operated from the rear of the furnace. The tilting arrangement is so designed that the centre of gravity falls just below the centre of radius of the rockers in any position, making a perfectly safe and well-balanced arrangement, with minimum wear-and-tear on the tilting motor and gearing. The tilting system is provided with limit switches, which give perfect safety in operation. All electrode arms are also provided with limit switches, preventing accidents when in the hands of careless operators.

On the larger furnaces there is a special roof-lifting feature, which takes away entirely the strain on the bricks of a new roof when being put into place.

Operating Characteristics

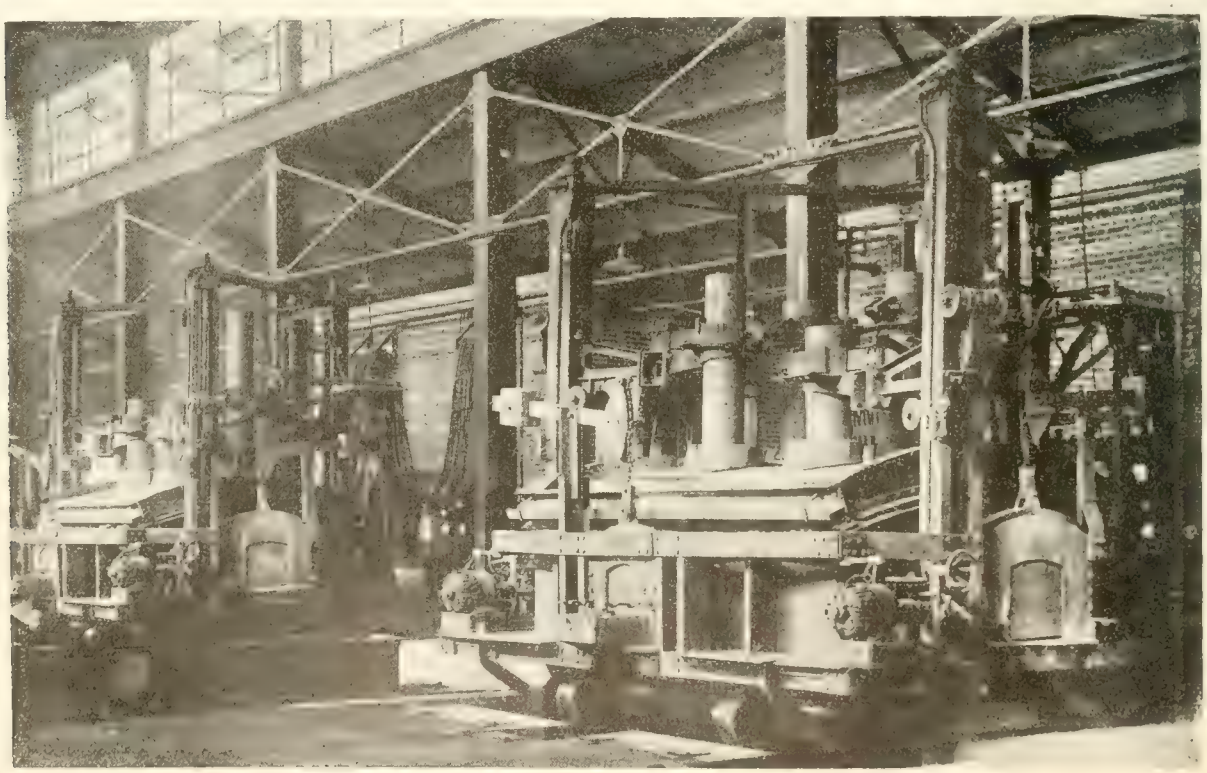
In the electric furnace, steel of any composition made by other processes can be duplicated, and the process lends itself further to the manufacture of steels which would be impossible of manufacture by older methods. Illustrating this point, it is perhaps only necessary to point out that practically all low-carbon steel containing anything from 7 per cent. to 14 per cent. of chrome—generally known as "Rustless Steel" is made in the electric furnace, using low grade high carbon, ferro-chrome and common steel scrap—the elements carbon, sulphur and phosphorus being satisfactorily eliminated.

The electric furnace process is essentially a basic one and the same reactions resulting in the oxidation and removal of phosphorus which are carried out in the basic open-hearth process can be applied in the first stage of melting a charge of common steel scrap in the electric furnace. The electrical process goes further, however. After removing the phosphate slag, another slag can be made up with lime, sand, and fluorspar, which, by closing up the furnace doors and spreading finely powdered coal on the slag, can be worked under reducing conditions. This results in the rapid removal of sulphur and in the reduction of silicon from the slag into the steel. The reduction of silicon can be carried to any desired extent and results in killing or deoxidizing of the steel.

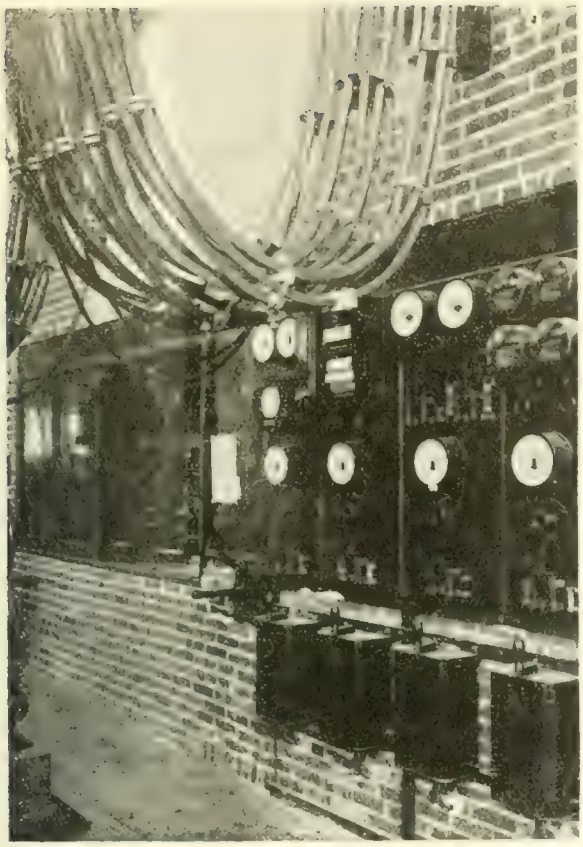
The electric furnace finishing slags are peculiarly light and non-cohesive in nature. The slag rises very quickly to the surface of the steel, and when the steel is teemed into ingots it is consequently free from slag fibre. This property has proved of enormous value, especially in the case of steels, which have to withstand sudden shocks and stresses, such as the driving parts of motors and various bullet-proof steel plates.

The making of steel in the electric furnace may be divided into two periods, the melting or breaking down period and the refining period. Anything which is of advantage in shortening the time taken for these periods manifestly effects a considerable economy in power and results in increased output.

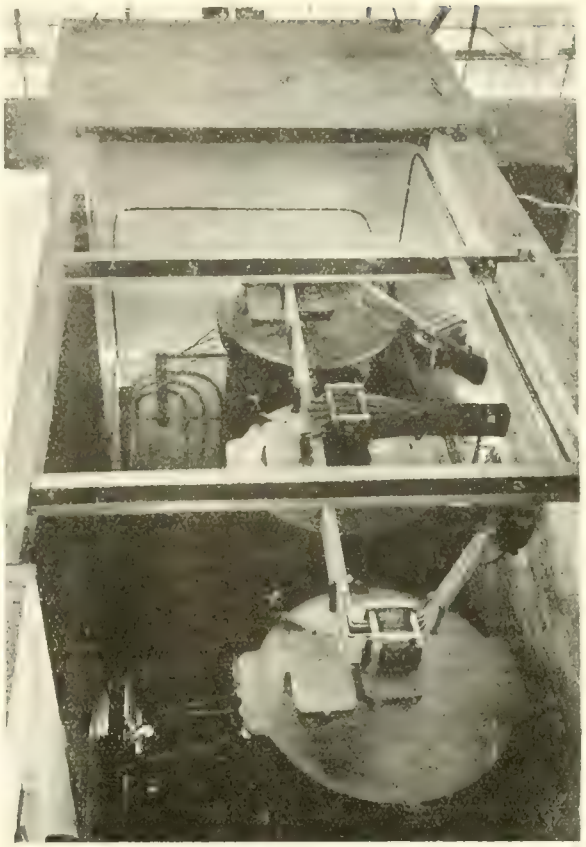
Since the current in the furnace under



TWO 6-TON FURNACES ONE OF THEM IS IN OPERATION. WHICH?



TYPICAL VIEW OF FURNACE CATENARIES AND CONTROL.



GREAVES-ETCHELLS FURNACE ARRANGEMENT OF LOW TENSION COPPER.

consideration flows through the metal and hearth, considerable heat is generated in both metal and hearth, as well as in the arcs immediately above. This results in an extremely short melting period. The refining period is also shortened since the slow circulation of the molten metal set up by bottom heating, carries all portions of the bath to top and effects an intimate contact of refining slags with every portion of the metal.

On basic linings, 3-ton furnaces equipped with 900 kv-a. transformer capacity are melting three tons of metal in one hour, forty minutes, and completing the melting and refining of a charge in two and one-half hours. Six-ton furnaces are melting in two and one-half hours and completing the heats in under four hours per charge. On acid lining furnaces these figures have been considerably improved.

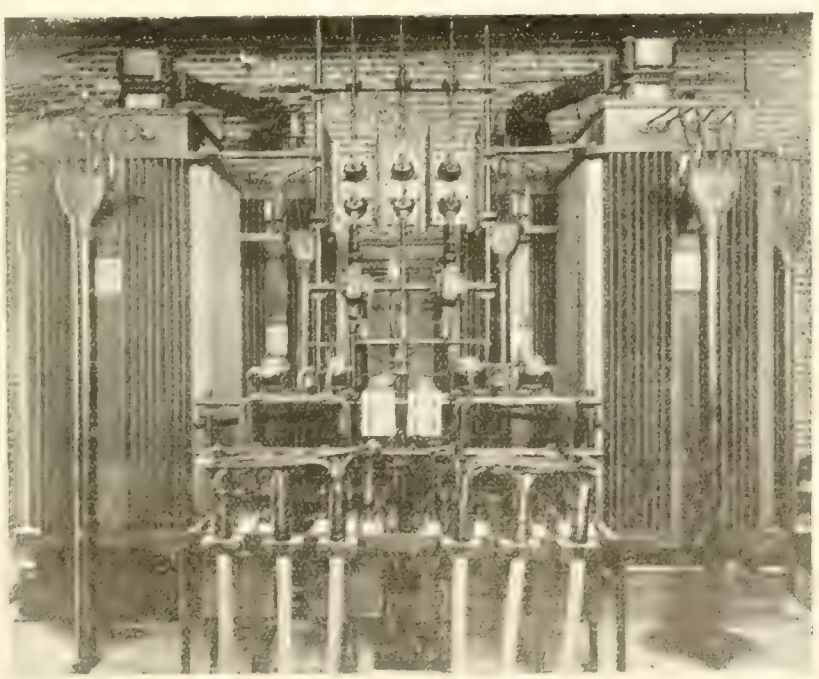
Electrode Consumption and Refractory Life

Conditions under which electric furnaces operate are usually of such a varying nature and the various metallurgical operations carried on in them are so different that it is almost impossible to make any accurate generalization as to the electrode consumption or refractory life.

It might be expected, however, that the operating features of the furnace now under consideration would lend themselves to economy. This is evident when it is considered that the hearth is used not only for the return of the current, but also for heating. Less heat is therefore generated above the bath and less carbon or graphite is consumed from the electrodes.

One user reports a life of 125 heats for roof, walls and bottom; these figures are from time of installation and it was estimated that the roof would last for 25 heats more before repairs would be necessary. Considerable refining was carried out in this instance.

Another furnace of one-half ton size has run for 15 months without repairs of any kind to the lining. During this time 220 heats were run off. This furnace and another of a somewhat similar record was used in the making of nickel-chrome airplane steels of intricate composition. The molten steel had to be held for refining and the proper



TRANSFORMER CONNECTIONS, 6-TON FURNACE, GREAVES-ETCHELLS SYSTEM.

adjustment of carbon, silicon, manganese, chromium and nickel contents.

Two-ton furnaces have consistently given 120 to 130 heats before repairs to the roof were necessary.

The furnace hearths, if properly cared for, seem to last indefinitely, one furnace having made over 3,000 heats on the one hearth.

Electrode consumption varies, of course, with the kind of steel made and with the duration of refining operations. The size of the furnace has also considerable to do with the consumption. By the use of economizers figures of from 9.1 lb. to 11 lb. of graphite per ton of steel are generally obtained.

Properties of Electric Steel

It has been mentioned that electric steel, aside from the properties conferred on it by alloying materials is possessed of marked physical characteristics which render it superior to steels made by other processes. That this is so may be seen from the results of tests made by one firm on the product of their Greaves-Etchells furnace:

	Steel A	Steel H
Yield point long tons	23.78	67.33
Maximum stress long tons	37.44	73.10
Elongation per cent.	32.0	21.50
Reduction of area	47.0	43.76
Brinell hardness No	156.0	
Stanton Impact Fig. 1560.		10200

Steel A was a mild steel with about a carbon of .15 per cent. and the test shows remarkable results.

Steel H was a nickel chrome hardening steel and the elongation is very satisfactory. The makers further stated that the Stanton Impact figure obtained was the highest obtained in their own laboratory.

Greaves-Etchells furnaces are made in ½, 1, 2, 3, 5, 6, 10, 15, 30 ton sizes by the Electric Furnace Construction Co., Finance Building, Philadelphia, and T. H. Watson and Co., Limited, Sheffield, England.

The method of obtaining a balanced primary from either a two or three-phase electrical supply and the method of generating heat in the hearth of the furnace are protected by patents.

At last the corn cob has come to its own. The cob has been relegated to the scrap heap for a great many years as a worthless appendage after it had served its primal purpose. It is true that pipes of peace have been made out of it, but now comes the Department of Agriculture and is ready to utilize it, for it has been found that 35 per cent. of it is transformable into crystalline glucose which has many uses, one of them being the production of alcohol. Another use is adhesive which is used in making fibre boards and paper boxes. This adhesive could be made colorless and would replace the starch, dextrine, flour paste, and only 3 per cent. of the cobs would have to be used to replace all this.

MAKING WOOD MACHINE HANDLES

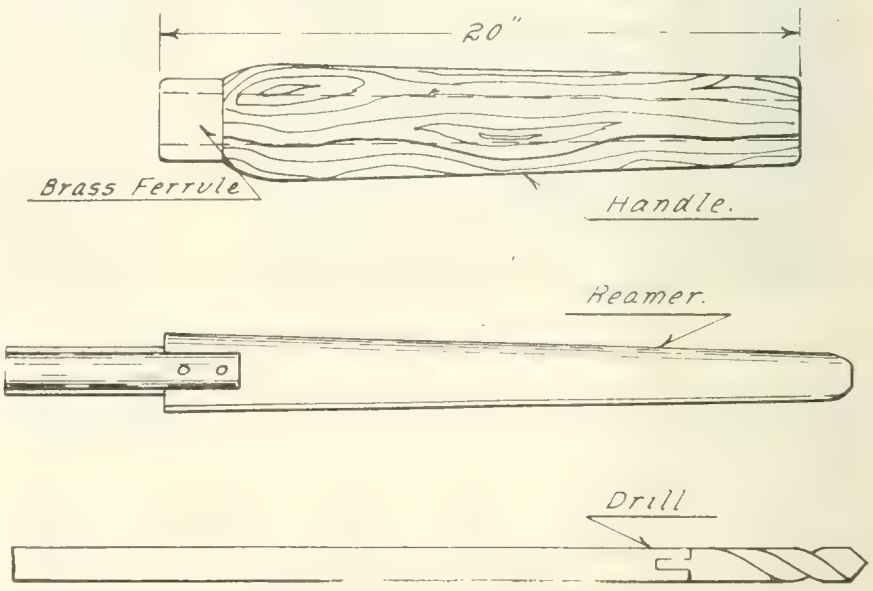
By Donald A. Hampson

We were getting out a line of machines that required a cherry handle of the general shape shown by Fig. 1. The inside had to fit a tapered steel core—the outside was turned to a shape that was pleasing to the eye and comfortable for the hands. We thought any of the wood-working shops in town could make the handles for us, and gave them little thought until almost ready to use them. Then we found nobody cared to undertake the job. In desperation, we asked, "Tell us how you would make them, and we'll try it ourselves." The reply was, "We wouldn't make them." Nothing to do then but apply machine shop methods—all we knew—to the wood-working business and try our luck.

Getting the blocks in squared lengths, they were set up under the drill press and the holes step-drilled, just as is done in roughing out taper holes in steel before using a finishing taper reamer. Our finishing reamer was shop made of a piece of ⅝-inch by 2-inch machine steel planed to right taper and set into a shank. With the shank in the drill press chuck, the taper "bore" was finished very quickly by running the reamer down. The surface was not altogether smooth (round), but it was straight from end to end, which was more important than the absence of chatter marks.

In doing the rough drilling the twist drills gave out at a depth of eleven inches. To reach the remaining distance, pieces of broken 13-16-inch and 1-inch drills were rescued from the scrap pile, softened, and ⅝-inch rods spliced on. These drills did very nicely for the work in wood. As an experiment, holes were drilled with carpenters' bits, but it was shown that they followed the grain of the wood much more than the twist drills, which fault produced crooked holes that did not clear up.

After the bore was finished, a section was turned a driving fit for ferrules of brass. And finally the contour was turned, using a long taper arbor on which the handles were "driven" by a thrust of the hand.



THE HANDLE AND TOOLS USED

The manager of the Queensland State iron and steel industry enterprise is recommending the Government to establish blast-furnaces and coke ovens for a start with a view to turning out pig iron and coke and other by-products, the proceeds of which would assist in financing the larger industry. He estimates a consumption of about 1,000 tons of coal a day and about 500 tons of mixed iron ore from Cloncurry (Mount Leviathan) and the Biggerden deposits. It would take about two years to establish the scheme for blast furnaces, etc., and another year and a half to complete the whole scheme.

Dealers in, as well as original sellers of, iron and steel scrap from explosive plants are warned by the Bureau of Explosives, New York, in a special bulletin, to guard against explosions caused by guncotton, picric acid, or T.N.T. inside of pipes or receptacles. The following are instances of such accidents: Damage to a metal plant in the melting down of lead pipe containing picric acid, explosion in a storage yard because of contact of a lighted match with nitrocellulose, the severing of a hand from an explosion resulting from the crushing of pipe between two hammers, killing of employees cutting up pipe from the oil fields of Oklahoma, in which a detonating cartridge had been left. One explosive company makes a double inspection of all pipe leaving its plants; it is first burned in a woodpile and then inspected, each piece being marked with red paint; after it is loaded on cars another inspection is made, markings with blue paint indicating it.

In order to make Switzerland less dependent on imports, the Schmidt-Roost Oerlikon Company have established a steel foundry, where scrap iron is converted into steel in electric furnaces.

The Use of Gauges in the Mechanical Field

A Paper on the Origin of Gauges With Various Systems Used. Allowances and Tolerances. Old Method of Go Gauges and Screw Thread Work

By E. C. PECK
Lieutenant-Colonel P. S. & T. Division, Standardization Section

IT IS a well known fact that gauges of some description have been used since men first began to contrive conveniences for himself. The standards of weight, measure and volume mentioned in the Bible are gauges. The instruments and appliances used in building the pyramids were gauges. In fact it has been apparent from the beginning of time that standards for determining dimensions, capacity, quantity, force, etc., are not only necessary, but aid materially in conducting all kinds of commerce and business.

In bargaining for a quantity of material it is necessary to have a standard unit acceptable to both buyer and seller to determine whether the quantity bargained for is understood by both, and the bargain carried out.

Tribes, states and countries used gauges originating with themselves, and probably the tribe or state doing the most trading with the neighboring countries succeeded in establishing their standards in other countries, and hence the most used gauges were handed down to us. It certainly would have been much better for the present generation if there had been little more co-operation among the ancients in regard to standardization, then we would not have the heterogeneous collection of gauges or units that we are all familiar with.

It must be evident to everyone that all business and commerce would be conducted with less expense for the service rendered if standard specifications were in use and had the same meaning all over the world. It would seem like a logical statement to say that some one system of standards ought to be enough better to win over the entire world by its greater utility, but this has not proved to be true. The two systems which most concern this country are the English and metric. Both are used extensively, both are legal and each has its advocates. It seems obvious that the outstanding advantages of the metric system have not been sufficient to supplant the English in this country. To me the outstanding advantage of the metric system is that all subdivisions are multiples of 10, and hence in calculations it is only necessary to move the decimal point in the reduction from unit to unit. Great advantage is also claimed in that the units of weight and volume are derived from the unit of measure, but to me this is of little account. For accurate work one does not want to originate his own standards, but prefers to obtain them from the Bureau of Standards, which can compare a standard without regard to its origin.

One advantage claimed for the English system is that most subdivisions are made by successively halving each unit. If these arguments are adhered to by the advocates of each side, they both fail, because their methods result in units the size of which are impracticable, based on experience.

In the English system, beginning with the inch and halving of each subdivision, we finally reach the units: 1-64, 1-128, 1-256, 1-512 and 1-1024—all of which are awkward to handle and not readable on the well-known micrometer without estimating. To obviate this difficulty, the inch is divided into tenths, hundredths, thousandths and ten-thousandths, and all of these decimal units are practicable and usable units.

In the metric system, the first subdivision of the meter is the decimeter, a unit 3.973 in., of no utility and rarely used. The next unit is the centimeter, a unit too large for good work and too small for use in distance measurements. The next is the millimeter, 0.03937 in., the most widely-used unit because of the adaptability of its size value. Many industrial enterprises require no greater accuracy than a millimeter, and therefore, as this unit is about as fine as can be used on a steel scale, it is sufficient for their needs.

For tools and fine accurate mechanisms, the millimeter is too large, and so is the next subdivision, 1-10 millimeter, which is 0.0039. The great bulk of good work in our machine-tool, automobile and the tool-making industries require units between 1-10 and the 1-100 millimeter, as one is too coarse and the other too fine.

The result of this is the halving and quartering of the millimeter and the 1-10 millimeter to get the usable units approximating 1-100, 1-1000 and 2-1000 of an inch. Thus it will be seen that the advocates of both systems use what the other claims as an inherent fundamental of his system.

If when the meter was adopted all romance and sentiment had been left out of the question, and the meter made 10 English inches, the metric system would have been in universal use long ago. The theoretical value of the meter is on a ten-millionth part of the distance from the Equator to the pole, and after this figure was established an error was found in the calculation, so that now we haven't even this sentimental advantage.

If the meter had been 10 inches, metric threads could have been expressed in whole numbers per decimeter, and this would agree with present practice, and would fit in with the United States system.

The First Interchangeable Manufacture

The first interchangeable manufacture attempted was in France in the year 1777, and [illegible] Gribeauval had one made in 1785, which also failed. In 1798, Eli Whitney, of cotton gin fame, took and completed a contract to make ten thousand muskets for the United States Government, and the parts of these guns were interchangeable.

English and French ordnance officers ridiculed and criticized Whitney's ideas to such an extent that Congress became alarmed at the money being used for the purpose. Whitney went to Washington with ten guns and distributed the parts on the floor, assembling repeatedly ten guns from these parts, that operated properly. This remarkable achievement astonished everyone, and it is believed to be the first successful interchangeable manufacture of accurate work. As nearly as can be found out from the records available, this occurred in 1800. In 1808, Simeon North accomplished a like feat on pistols for the Government.

It is also known that John George Bodmer began to manufacture guns at St. Blaise in the Black Forest about 1806 by a new method, which is believed to have been partly interchangeable; that is, some of the parts like the lock and stock were made and carried in stock. Interchangeable manufacture is conceded to be an American development, and is described by writers on the continent as an American method. In 1853 a British commission visited the United States to investigate the methods in use, and as a result ordered 20,000 Enfield rifles for the British Government, and later 157 machines for the Government arsenals, and hired James H. Burton to install the machinery and methods.

From this small beginning the practice grew steadily in the armories and arsenals, and later as the advantages became known, it spread to bicycles, typewriters, and various other things, until now it is quite common to speak of interchangeable manufacture. There is no doubt but there is some difference between the exact meaning of the term then and now, just as there is a great difference between manufacture then and now.

There are several degrees of interchangeability, or at least several meanings to the exact interpretation of the term. Strict interchangeability consists in making the different parts of a mechanism so uniform in size and contour that each part will fit and properly function in any one of the whole number of mechanisms, no matter when or where it is made.

In the early days before modern machinery came into use, it was necessary to finish work by hand, and to make it uniform, template filing and finishing were resorted to. For example, gun and

pistol parts would have the holes drilled and reamed in a jig or fixture, and then the contour finishing was done by putting these pieces into a template jig provided with pins to fit the holes. The outside of the jigs would be a duplicate of the shape and size of the model piece and hardened. The workman would then file down to the hardened template, which controlled the shape and size of the piece. Many ingenious devices and schemes were used to facilitate the duplication of parts, and great skill was developed in the workmen.

The great improvement in machine tools, especially as to accuracy of output, was a very great factor in promoting interchangeability, and here again, America had led the world. The refinements, accuracy and efficiency of modern machine tools are strictly American.

American labor costs so much more than foreign that to compete in the world markets, we had to obtain as much product for each dollar of labor as our competitors, therefore, we had to develop machinery to get more product for less labor. This in turn has developed skill in our mechanics, and raised the standard of living so that to-day American skilled workmen are the best paid in the world.

It is a fundamental law that interchangeable manufacture is facilitated by the largest allowable freedom in the fit of mating parts without interfering with the proper functioning.

Allowances and Tolerances

This leads up to the subject of allowances and tolerances, one of the simplest, but least understood in the whole system of interchangeability. As these two words will be used repeatedly, it is well to point out the difference between them.

Allowance is a prescribed difference between the dimensions of two mating parts to produce a desired kind of fit. Example: A standard hole exactly 1 in. in diameter, with a free running shaft, the journal diameter of which is 0.998 in. The difference between this hole and the journal prescribed for the oil is 0.002 in. and this is the allowance.

Tolerance is the prescribed difference in the dimensions to tolerate the unavoidable errors or variations in manufacturing a large number of pieces.

In the above example, if a thousand running fits were to be made, the holes might be dimensioned 1.000 in.

+ 0.005
—0.0000

This half thousandth permissible error is the tolerance.

The shaft journal might be dimensioned 0.997 to 0.998 in. and this permissible error of 0.001 in. is the tolerance. Then the minimum allowance is 0.002 in. and the maximum looseness or the sum of both tolerance and the minimum allowance is 0.0035 inch.

Thus the kind of fit is finally determined by the combination of the allowance and tolerance, and most engineers prefer to use allowance as a minimum value, which is never intentionally encroached upon, the tolerance providing for larger freedom of fits. The reason for this is that the data for minimum allowance is more reliable and has been more clearly demonstrated than the maximum allowance, and as it is vital, it must be unaffected by tolerances. This is plainly evident in the case of free moving parts, as it is well understood that a space must be provided for an oil film, and this space must not be so small as to endanger failure by the parts seizing.

There are many conditions in which maximum looseness determines the strength of the parts or the limits of engagement, and any more freedom of fit would make the parts unsatisfactory. When this is the case, maximum looseness must be the starting point in the calculations, and this must then be unaffected by tolerance. Then if minimum allowance can be determined, the difference between these two, maximum and minimum looseness, will be the sum of the tolerances.

The tolerances are then divided between the mating parts according to the manufacturing ability to produce the parts to uniform size. That is, if the manufacturing ability is such that it is much easier to produce uniform size to one member than the other, the tolerance on the members is divided in direct proportion to this condition.

Very often the allowance has zero value; that is, there is no clearance whatever allowed for the fit, and in a single pair of mating parts, they fit metal to metal. Now if a large number of such parts are to be made, it must be determined whether this zero allowance is for the tightest or the loosest fit permissible.

The term "negative allowance" is often used to indicate that we allow a certain prescribed amount to make a tight or force fit, and is very confusing because it implies being subtracted, and this is not the case. According to present usage, zero allowance indicates that there is no clearance or space allowed between the two mating parts. Positive allowance indicates that there is prescribed a space between the mating parts. Negative allowance indicates that there is less than a space provided for between the mating parts, or an imaginary space displaced by the flow of the metal to make a tight fit.

The minimum allowance or greatest tightness and maximum looseness must be known when the tolerances have been set, and usually they are known at the time tolerances are set. There are, however, cases in which it is known that certain tolerances are the smallest that can be successfully used in manufacture, and then maximum looseness and maximum tightness must be adjusted to obtain the best functioning condition in conjunction with these tolerances.

After determining the maximum and minimum looseness of mating parts and setting the tolerances, it becomes necessary to control the dimensions of the parts so that none of the dimensions will be outside of the limits established, and that is best done at this time, for strictly interchangeable manufacture by the use of proper "go" and "no-go" gauges. First-class gauges are expensive, and soon wear, so that strict interchangeability is sacrificed to keep down gauge cost.

Old Method of Using "Go" Gages

In times past it was common practice to use "go" gauges only, and limit the looseness of fit by the shake of the piece in the gauge, or where a little more refinement was practised, a piece of newspaper was used on one side of the "go" gauge, and if the piece which passed without the paper, was tight with the paper, it was accepted. A piece of newspaper used with each of a pair of mating "go" gauges usually produced a freedom of fit from 0.004 to 0.006 in., and with skilled help, it produced satisfactory results.

For strictly interchangeable quantity-production work of good character, a good gauging system will prove economical. Such a system comprises the minimum number of properly designed gauges to control all the factors of the various parts of a mechanism, so that they will assemble and function properly. This assumes that proper allowances and tolerances have been established.

The designer should always keep before him the fundamental that tolerances should be as large as proper functioning will permit, and he should be well informed what tolerances successful manufacturers actually work to. He should take pains to learn how tight and how loose working parts can actually be, and give satisfactory results.

Once these tolerances are set as large as the designer will risk, they should be rigidly adhered to, and considered a boundary line. The product should always be kept within these boundary lines, and this is best accomplished by making the component drawing dimensions the master-gauge dimensions. Then with all the working and inspection gauges checked against master gauge, and never allowed to wear beyond master-gauge dimensions, the work is bound to be within component dimensions.

An exact duplicate master gauges cannot be made expect at a prohibitive cost, a master-gauge manufacturing tolerance is allowed. This tolerance is usually in good practice from 4 to 6 per cent. of the component tolerance, and is applied in the direction to keep the work within the boundary line defined by component dimensions. This gauge tolerance is treated as a wear limit, and robs the working tolerances by this 4 or 5 per cent.

Inspection gauges are usually of the same design as the working gauges, and after the same as the master gauges, but should have an additional allowance for wear. Inasmuch as the gauges will wear, and as they are expensive, the exact amount to allow for wear is an economic point for each manufacturer to decide, keeping in mind that a small wear limit increases gauge cost, and a large wear limit requires closer attention and work at the machines.

Where experience is lacking, it is good practice to allow 10 per cent. of the com-

ponent tolerance for wear on the "go" gauges; as the "no-go" gauges wear but little, 5 per cent. will be sufficient. The inspection gauge can only represent extreme tolerance limits when worn to master gauge size. The working gauges are those used to check the work as it is machined, and should have liberal wear limits to insure the work being passed by the inspection gages.

Thus is will be seen that this system, if followed, wil admit of the acceptance of work that will be interchangeable. It also emphasizes the fundamental that tolerance should be as large as will properly function.

If the tolerances are too small the work will be more costly, because better workmen wil be required, and this always means higher wages. Better tools and machines to produce the close work and more frequent adjustment and attention is also necessary as well as additional gauge cost. Close tolerances cause large rejections of the work, and more or less friction between the inspector and those responsible for the work.

Screw-Thread Work

The examples and descriptions so far have applied to all kinds of interchangeable work with no particular reference to screw-thread work, and while the principles and practice are the same, a great deal more care is required to produce strictly interchangeable screw-thread work than plain work. The problem becomes more difficult because a larger number of factors make up a proper screwthread fit, and a big error in any one of the factors, will prevent a proper fit. A comparison of these factors may help to make the solution more comprehensible. A cylindrical fit depends upon the size, rotundity and parallelism of the mating parts. Rectangular sliding fits depend upon size, contour, and parallelism of the mating parts. Of course, they all depend upon size, but in a screw-thread fit, size is affected by the errors of the lead in the mating parts, and the errors in the angle of the thread. Thus the factor contour in a screw thread is made up of the factors of lead and form of thread.

Two mating parts with correct lead require no compensation in size for the lead factor. Two mating parts with an equal lead error in the same direction, either long or short, require no compensation in size for the lead error. Two mating parts with different lead errors or the equivalent, require a compensation in size for this lead difference to enable the mating parts to go together.

Two mating parts in which the contour of the thread is affected by an error in the angle of the flanks of the thread, must also have a compensation in the diameter to offset the angle error, or the metal must flow to make the fit. Thus it will be seen that strictly interchangeable screw-thread product is more difficult to produce, and if good fits are required, close tolerances and good thread-producing tools are necessary. There must be a rigid inspection and means of controlling all factors which make a fit.

Where gauges are used, as at present time, they must be periodically checked against master gauges in order that boundary lines are not encroached upon. It is fundamental that the "go" gauges should check all factors simultaneously, and the "no-go" gauges should check factors separately. Thus it must be obvious when it is remembered that lead and form are compensated for by increasing the diameter, and hence to be sure of the correct relation of all the factors to each other, they must be gauged at once and with a gauge as long as the engagement of the mating parts. The exception to this is the minor diameter of the nut, and the major diameter of the screw. To include these two dimension factors in the "go" gauges, would make cost of the gauges prohibitive, and as these surfaces in the mating parts are intended to be cleared when assembled, it is practicable to get gauge them separately.

Some idea as to the cost of iron castings in America at the beginning of last century may be gained from some extracts from the minutes of the Albany Waterworks Company—published in the "Engineering News Record." On May 1, 1813, the trustees of the company opened the following tenders for cast iron conduits: (1) From Thomas Trenor, of Bennington, 128 dols. per ton, of 3 ft. length; (2) Eliphalet Sturtevant, New York, 140 dols. per ton, of 3 ft. length, or 120 dols. for 2 ft.; (3) Holly and Hoffing, of Salisbury, Conn., $100 per ton, "in joints of one length of 2 ft. each." The contract was awarded the same day to the last-named and lowest bidder, but with the proviso that the bidder supply 200 joints, "carefully cast, as a fair sample of the work, agreeably to a description laid down on paper by the superintendent and enclosed to them (the bidder) in order that a fair experiment may be made of the strength of the pipes according to the proposed dimensions, and that this Board will be ready to enter into a contract on the subject at any day when the parties will attend." Apparently the low bidder gave satisfaction, for on October 4, 1813, the trustees resolved to contract with Holly and Hoffing for 150 to 170 tons additional of cast iron conduit delivered on the dock in Hudson by November 1, 1814, at 100 dols. a ton.

A GLUE JOINT TEST

Glue joints between wood surfaces which have been coated with shellac or varnish have low or very erratic strength. This has been thoroughly demonstrated by a recent test at Forest Products Laboratory, Madison, Wis., U.S.A. Sixty pairs of test blocks were prepared in which one or both wood surfaces were varnished or shellacked, and were joined with either casein or animal glue. A great many of these blocks fell apart before testing, and all which held together long enough to be tested sheared apart in the glue joint and not in the wood. The highest strength value obtained was 1,712 lb. per square inch, which is low for casein glue. The other values were 1,000 lb. per square inch or less. It is evident, therefore, that all shellac or varnish should be carefully cleaned from wood which is to be glued, if high strength is desired. A few blocks were joined using shellac as a glue over surfaces previously coated with shellac. The maximum shear strength obtained was 1,425 lb., the minimum 450 lb., and the average 758 lb. per square inch. These values are low, and do not indicate that shellac has gluing properties which compare favorably with casein or animal glue.

THE AIRPLANE AS A PACKHORSE

The feasibility of transporting machinery and supplies by airplane to the numerous gold and silver mines in the States of Sinaloa, Mexico, is to be investigated by the British Government, according to an article in a recent issue of "Commerce Reports." According to the story, it appears that a British company is prepared to organize and operate an air service between the mines and railway stations for the transportation of machinery and supplies to the mines, which, due to their mountainous location and the absence of roads, at present are practically isolated. At present it is practically impossible to transport heavy machinery to these mines, and the only machinery which can be transported must be carried on the backs of burros, whose maximum limit of carrying is about 300 pounds each. It is understood that it would be the purpose of the proposed company to transport machinery weighing several tons.

RECENT INVENTION

A recent British invention has been made whereby the piston of an internal-combustion engine may be cooled by means of a draft of air circulating through a space in the piston. The draft is provided by means of fan blades on the engine flywheel. On either side of the hollow piston are ports which register with corresponding ports in the cylinder walls at the end of the stroke. A draft of air is thus forced through the hollow space in the piston while all the ports are in line.

Certain French financiers are contemplating the establishment of a large institution in Paris, with a view to centralizing trade. The building would contain samples of all the products of the world, classed in groups. Each storey would contain galleries for the sale of all kinds of imports and exports, together with a special staff who would supply information with regard to specialized branches of all trades. There would be information bureaus with interpreters, stenographers, etc., attached, and electric power to work the exhibits.

Canadian Machinery Drafting Course Part VIII

This is the Last Plate in Projection. Study the Principles Carefully, for it is the Underlying Principles That Count. Once You Realize WHY You Do Certain Things, the Rest is Easy

By J. H. MOORE, Associate Editor, Canadian Machinery

BEFORE going into this eighth portion of the course, let us discuss a very important matter, relative to the course and its procedure. As the writer explained when commencing this series of studies, it would be impossible to go very deeply into the various subjects and classifications, without taking up too much of the students' time, and perchance making the course very long and tedious.

For this reason we believe it would be good policy to outline, as it were, what is ahead of the student, to show him that we are keeping in mind the fact that it is not our intention to keep him longer than is absolutely necessary on the theory of drawing and its various underlying principles.

Starting with this portion, which is the last in projection, we will take up one plate on conic sections, one plate on intersections, together with developments, after which we will branch directly into mechanical drawing, so, as readers and students can see, it will not be long before they enter the strictly mechanical field.

After entering the actual drawing of portions of machines, etc., the student will take on an added interest. The writer speaks from personal experience, for he has passed through the mill and knows how it goes. He remembers well that he used to remark when studying all the elementary principles, "But what's all this got to do with mechanical drawing?" He later found out, however, that his time was well spent. His course of study, incidentally speaking, was a long (and to be honest) a tiresome one, stretching over four years, not covering ground as we are attempting to do here in this series of lessons.

Now that we have shown students just what our plans are for this work, let us get on to the present lesson.

Students will easily remember the last plate which illustrated various problems in projection, first showing the sketch, and later the mechanical drawing, or projected view. No doubt the principles underlying the subject were thoroughly mastered, at least we will assume so, and go on to four further problems of an entirely different nature.

The objects on the last plate were all made or drawn under the supposition that either the centre lines, or at least one flat side, was parallel to the plane of the paper. The centre lines of each object were also either vertical or horizontal.

Such conditions are always possible when making detail drawings, where each piece is drawn separately by itself, but in the case of machines, especially intricate machines, where the parts are drawn at different angles, they cannot always be drawn in this manner, which naturally makes it a little more difficult.

The objects shown on this plate are not so difficult in themselves to draw, but they are placed at different angles to illustrate and educate the student into this new condition of projection.

Particular care should be taken to study and understand this plate, in fact, all plates, to follow between this and the actual mechanical drawing, for if the student thoroughly masters the principles of this plate, and those to follow, he will experience no difficulty later on in the course.

To commence with plate No. 8, let us look at Fig. 1.

Here we see a rectangular prism at A, which is 1½ in. long, 1¼ in. width, and ⅝ in. thick.

The problem now consists of constructing this prism, standing in a perpendicular position on one of its small ends, in such a manner that the broad sides form an angle of 30 degrees with the horizontal line.

Of course, the plan in this must be drawn first. To do this, draw the rectangle 1, 2, 3, 4, with the sides 1, 2, and 3, 4, forming 30 degrees with the horizontal. This may be easily done, by means of tee square and 60-30 degree triangle, which readers are, no doubt, well familiar with.

To construct the front elevation, draw a horizontal line, 11, 14, and project down the point 1 upon this horizontal line, thus obtaining the point 11. Now draw 11, 18, 1½ in. in length, namely, the length of the prism. Next, draw the horizontal line 18, 15. Continue to project down the points 2, 3, and 4, from the plan on to the elevation, making the points of intersection at 12, 13, 14, 15, 16, 17, respectively. The line 12, 17 is dotted, because, as is plain to be seen, this point is a projection of the corner 4 in the plan view, which would be hidden in the elevation.

The side elevation is now a simple matter. Project lines 11, 14, and 18, 15, until they reach 22 and 23 respectively. Produce a line from point 2 in the plan till it reaches the point 29; also produce a line from 1 in the plan until it reaches the point 27. Produce another line from point 4 till it reaches point 28, as shown. Now proceed further with your side elevation.

Take your dividers and measure the distance from point 29 to 3. Come down to the side elevation, and lay this distance off as shown at 19 to 20. Next, take distance 29, 27, on plan, bring it down in similar manner, which now is 19 to 21. Last, but not least, take the distance 29, 28, on the plan and mark it off on the elevation, which is, of

What is the Purpose of Our Drawing Course?

A SHORT time ago CANADIAN MACHINERY received a letter from Mr. A. M. Lount, master mechanic of the Massey-Harris Co., Toronto, regarding our course of studies.

To receive a letter from a busy man such as Mr. Lount is proof to us that our efforts are appreciated. He spoke as follows:—

"In comment of your course, would say that the writer has found several of his men who are following this course, and is very pleased with the idea, but would suggest that you call attention **strongly** to the point that a course of this nature is particularly valuable to the man on the machine, or the bench, just as much as it is to the beginner in the drawing office.

"With reference to the course itself, would say that so far it appears to have been very cleverly designed and is just about the thing that is needed."

WE appreciate Mr. Lount's interest, and can only emphasize what he has already stated, namely, that the man on the bench can make good use of these lessons.

He will become more adept at his daily task, prove of more value to his firm, which, in turn, will prove a means of increasing his salary.

All are welcome, no matter what position they hold. Our only means of knowing how our work is taking root is to hear from you. Let us have both your opinion and your suggestions.

We have an important announcement to make in our Dec. 18th issue relative to this course. Watch for it.

course, 19 to 22. Now construct your side elevation complete, remembering to make the line 21, 24 dotted, because point 1 would be hidden in a side view, such as we have just projected.

Moving to Fig. 2 we also find a rectangle of similar size, but in a different position.

Here the prism is shown with the narrow sides parallel to the plane of the paper, but the object is now tipped until the base makes an angle of 15 degrees with the horizontal.

The procedure is very similar in this case. We start from the titled elevation view, and from this project the side elevation and the plan. Briefly, you project points A, B, C and D as before, these terminating at M, N, O, P, Q, R, S and T, the distance M T being 1½ in. The side elevation is projected as follows: Produce points A, B, C, D till they reach F, H, J and L. The line E F equals M T or 1½ in., the length of the prism. The reason for the lines N S and R H being dotted is self-apparent, they being hidden lines in their respective views.

Fig. 3 is next in order, and represents a hexagonal prism 1½ in. long, 1 in. across the flats. The student is expected to draw at the space B, how such a prism would appear to the eye, just the same as we showed at A, in Fig. 1, how the rectangular prism appeared to the vision.

Starting from the plan view we construct the hexagon 1, 2, 3, 4, 5, 6, in either of the following manners:

Draw a circle 1 in. in diam. and draw both centre lines, projecting the vertical one down to be used in the elevation view. As there are 360 degrees to a circle we can easily see that 6 (the number of sides to the polygon) divided into 360 equals 60 or 60 degrees. You can therefore divide your circle up into sections of 60 degrees, joining with lines tangent to the circle at these points, which, of course, will make your hexagon.

A much easier method, however, and one you will use later on in the course, is as follows: Draw your circle 1 in. diam. as before; then draw your centre lines, and with your 60 degree triangle and T square you can easily accomplish the rest. Run your triangle along the T square until it is tangent with the circle, and draw your lines. This constructs the lines 2, 3, and 5, and 6, 1, 2, and 4, 5. Now draw parallel lines 1, 6, and 3, 4, when your hexagon is complete. The front elevation is a simple matter. Merely project down your points 2, 3, 4, and 5, till they reach the line, 7, 10, which you draw in whatever position to suit your convenience. Next, lay out the line 7, 14, 1½ in. long, and produce this horizontally till it reaches point 11, after which complete the front elevation, 7, 8, 9, 10, 11, 12, 13 and 14. The next step should be watched carefully, for we desire a side elevation as if the vertical prism were looked at in the direction of the arrow, namely, at an angle of 30 degrees with the horizontal.

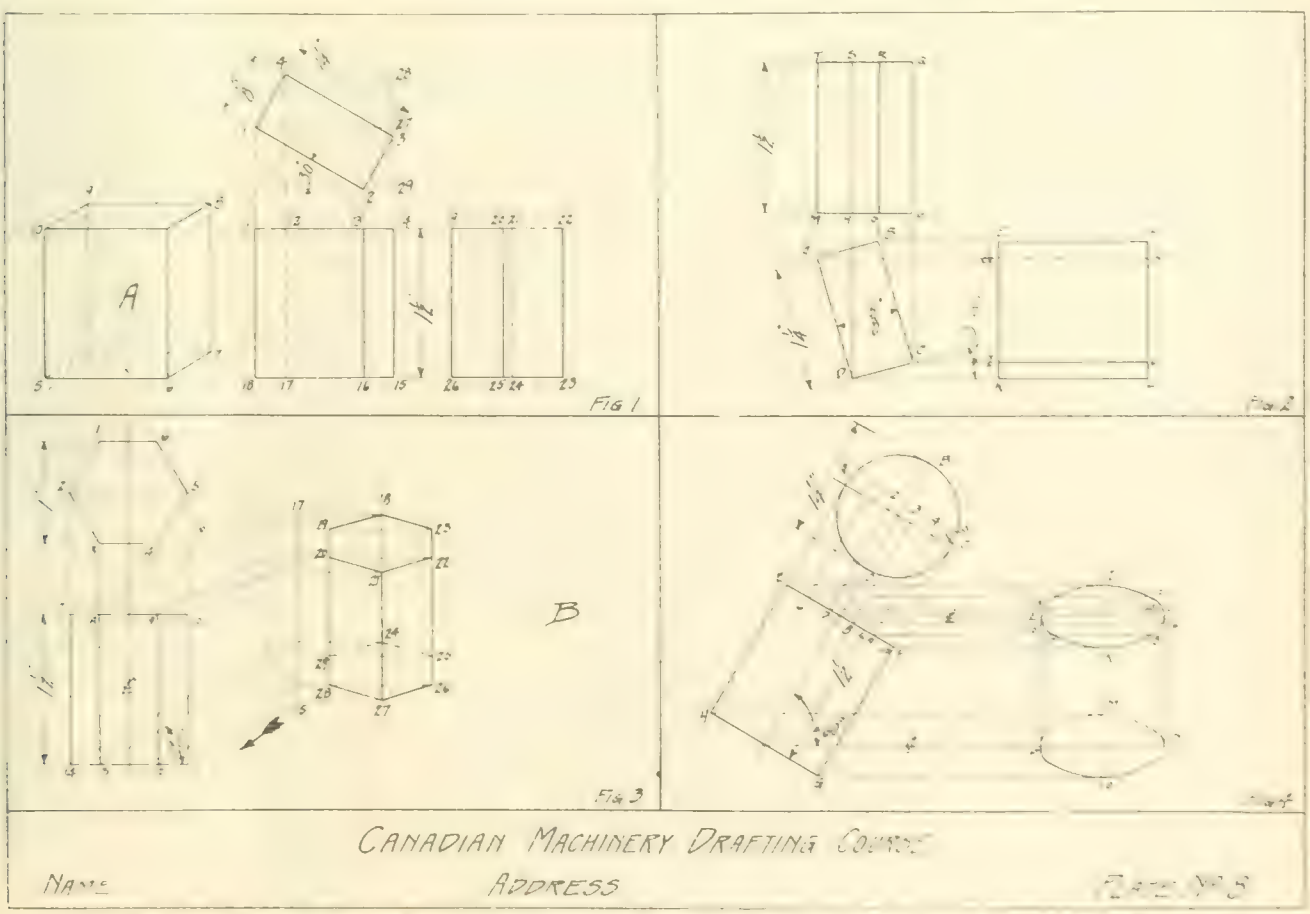
Tear off and send with drawing

Name

Address

Position

Firm's name.....



NOW WE START ON THE WINTERS' WORK SEND YOUR PLATES IN AS FAR AS POSSIBLE

points 7, 8, 9, 10, 11, 12, 13, and 14, a series of lines each at a slope of 30 degrees, as shown. At some point as 15, which can be placed to suit your own convenience construct a line 15, 16, perpendicular to these lines already projected. With the point 15 as a centre, describe arcs from every point where the lines already projected cut the line 15, 16. Continue these arcs until they meet with the line 15, 17, which is a line perpendicular to the horizontal plane.

From these points project horizontal lines as shown till they go to points 18, 23, 22, 25, 26 and 27.

Draw the line 18, 27 as a centre line for your side elevation. This line can also be drawn in any position to suit your convenience. On each side of this line space off distances equal to ½ in., or one-half the width of the hexagon. The rest of the construction is self-apparent, for all that is now necessary is to join the various points together, as shown on the plate. Do not forget to construct at B the prism as you believe it would appear to the eye.

We now come to Fig. 4, the last on this plate. Here we see a cylinder whose axis is parallel to the plane of the paper, but which makes an angle of 60 degrees with the horizontal. In this case it is the vertical side projection which is required. As will be noted, this cylinder is 1¼ in. diam. and 1½ in. long. Construct the plan, and front projection as shown. On the centre line of plan, that is the line A C, space off into 5 equal parts as at 1, 2, 3, 4, and 5. (Note: In this case we only call for five, but this line can be divided into as many parts as desired depending upon the accuracy required).

From these points project the lines until they reach the points 6, 7, 8, 9 and 10 on the line E F. Next project horizontally these lines until they reach the points I, 12, J, 16, 18, and K, likewise at the bottom in similar manner. Now, take point 1 on the plan. Set your dividers on this point and measure off a distance from 1 to where the projected line touches the semi-circle A, D, C. Lay this distance off at the side elevation in this manner:

On each side of the centre line I O, lay off the distance just measured; this will now make the points 11 and 12, also 17 and 18, for a distance from 1 or 4, in the plan to the semi-circle would, of course, be the same.

Next, from the point 2 take a distance to the semi-circle, and lay this out on the side elevation, making the points 13, 14, also 15, 16. Of course, a distance taken on the centre line of the plan at B D will equal the distance L J on the side elevation. The student is left to complete this figure, as he proceeds in an exact similar manner at the bottom portion of the cylinder.

Above all, study this plate carefully and grasp the fundamental principles involved, after which you have nothing to fear.

As before, make your plate 13 x 9 to border lines, and 13½ x 19½ over all. Ink in all the complete work, including dimensions, figures and letters. Add in as usual the title, name, etc., then let us pass on your work, and see if you land one of the prizes. Watch for the next plate on Conic Sections, and remember the sooner we get through the next few plates, the sooner we enter the mechanical drawing in its regular shop form.

Stamped vs. Cast Wheels for Light Railway Cars

Pressed Steel is Lighter Than Cast Iron, but Not So Durable, but Both Have Their Advantages.

IN a recent number of *Canadian Machinery*, there appeared an article on the adaptation of automobile busses to railroad work. The matter of wheels is of greatest importance in the success of an application of this kind and as this may be new to some of those who wish to experiment with such cars, a little information on the subject will be given, though without going into technicalities.

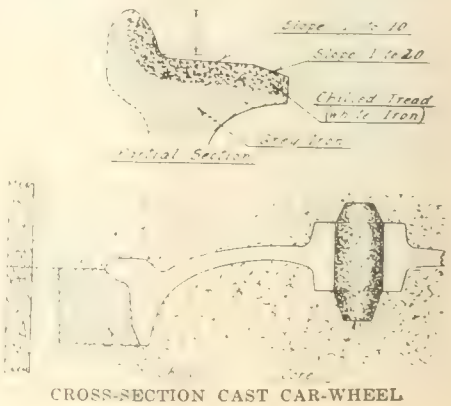
The pressed steel wheel is the lightest that can be secured as well as the most inexpensive in the first place. They are carried in stock in sizes up to 22 in., and may be had on order larger than that. These wheels are tamped and formed out of sheets of steel of 3/16 in. to 5/16 in. thickness, the tread, flange, and spokes being all one piece. Cast iron or steel hubs are riveted to the spokes. These wheels are extensively used on motor cars for workmen's use, their light weight makes them valuable where one man has to go to a distant point to do work and he must alone remove the car from the track while working.

In daily service on a heavier class of work these wheels have only one thing to commend them and that is their availability—as they are carried in stock in standard sizes and can be obtained on short notice (and at low cost). Where the weight on each wheel is as low as 500 lbs., the speed up to 30 miles per hour, and, say, a hundred miles running per day, the wheels will cut through at the base of the flange in three months; as a matter of fact, they are not intended for such severe usage, though they serve the purpose admirably if watched and renewed in time.

The vast majority of wheels in general use are of cast iron with chilled treads and such wheels naturally do unusually well on motor cars. The objection that rises to them is their over-strength and the excess of weight over what is needed for the work. Unlike the pressed steel wheel which is sold by the piece or pair, the chilled wheel is sold on a basis of cents per pound of weight—at this time around 4½ cents per lb.—and in such buying the customer pays for a great deal more weight than he needs. Some foundries have 30 in. patterns and chills but most of them make sizes 33 in. diameter or larger and these wheels weigh 500 lbs. or more and have capacities of eight to ten tons, under which loads they are supposed to give about 70,000 miles of service.

Thus the stock chilled wheel is somewhat expensive and its weight puts additional stresses on running gear parts at high rates of speed on curves. Foundries which cast street car wheels are in a position to supply lighter wheels for motor cars because the street car wheel is spoked which reduces the amount of metal in the "plate," as that part of the wheel between the hub and the rim is called. And the street car wheel is amply strong for any motor car usage. The one disadvantage of the stock street car wheel is its narrow tread, made purposely narrow so the wheel will not ride on the paving bricks laid next to the outside of the rail. Where the gauge of track is not carefully looked after, there may be sections such as on curves where the gauge is so wide that the narrow wheels will drop in between.

The objection to street car wheels noted in the last paragraph may be overcome by making new patterns and chills, but that is expensive unless a large number of wheels are required. As the additional width of tread is used and needed but little, an inexpensive method of getting this width with stock patterns may be resorted to. A temporary piece is added to an existing pattern, building



CROSS-SECTION CAST CAR-WHEEL

the tread out to the standard M.C.B., or any width desired. Then the castings are made as before except that there is a ring of unchilled metal at this one point and this soft ring answers the purpose of a safety—it gets so little service that the wear is negligible.

It is possible for any iron foundry to make car wheels of a sort. If a chill of correct proportions is made up and castings made against this, a certain amount of chill will be apparent on the face; however, it will not be the white iron of the car wheel foundry and the chill, instead of being ⅝ in. deep, will be only 1/16 in. to ⅛ in. deep. Such wheels will give a certain amount of service and have the advantage of being everywhere available. A few words in regard to the work may not be amiss.

The web (plate) or the spokes should not be straight, that is, they should not coincide with the plans of the wheel, but should be curved or reverse curved with liberal fillets at the hub and tread. The shrinkage makes necessary the precaution just named. The wheel pattern does not have to be exactly fitted on the outside, for the chill forms this part of the casting and with this machined out, the wheel should come smooth and true within 1 32 in. A pattern, of course, is required for the chill; it includes only the inner half of the flange; it should be three or four inches thick to provide mass enough of cool metal to cause chilling. Sometimes the foundryman uses water on the chill to assist. With one chill, one wheel a day may be cast.

Regular car wheel foundries use an entirely different mixture of irons from general foundries and this is responsible for the hard face obtained on their wheels. This latter is so hard that the castings have to be annealed for a week in special ovens called "soaking pits" before it is safe to use the wheels.

Metallurgy in the Manufacture of Steel

This Paper Discusses the Introduction of Vanadiaum. The Proper Selection of Raw Material. The Rolling of High Speed Steel and Other Vital Points in Manufacture of High Speed Steel

By ROY C. McKENNA

IT was with some hesitancy that I accepted the invitation of the American Steel Treaters' Society to present this paper. The writer is not a metallurgist; therefore the paper is nontechnical.

The manufacturers of tool steels heartily endorse the principles and objects of the American Steel Treaters' Society. For centuries the secret art of making tool steel has been handed down from father to son. The manufacture of tool steel is still an art which, by the aid of science, has lost much of its secrecy.

No industry is more liberal in the use of scientific men, yet tool steel is today made by practical men, skilled as melters, hammer-men and rollers, each knowing his art. These practical men willingly accept guidance from the chemical and metallurgical departments. The success of this co-operation between the practical and scientific men engaged in the manufacture of tool steels demonstrates the need of a society such as this.

There are now in existence perhaps too many strictly scientific societies, several of which could carry on a scientific investigation of the heat-treatment of steel, but the results of these investigations would probably be of no immediate benefit to the practical man who knows the heat-treating of steel from a practical standpoint. The American Steel Treaters' Society recognizes that the scientific man has much to learn from the practical man; also, the practical man has come to recognize that there is not so much difference between theory and practice when discussions are not camouflaged by technical terms.

The success of the society depends upon its ability to accomplish the purpose set forth in its constitution, namely: to secure co-operation between practical steel treaters and metallurgical departments, so that they may understand each other and each benefit thereby to the end that the truth be brought to light.

A knowledge of conditions existing today in the manufacture of high speed steel is essential to steel treaters. As a manufacturer of high-speed steel, I am glad to give in this paper such information as I am able. It is well for the manufacturer to have steel treaters understand some of his troubles and difficulties, so that they will better comprehend the necessity of certain trade customs and practices, and, realizing the manufacturer's desire to co-operate with them, will reciprocate. This understanding will be mutually beneficial.

The manufacturer of high-speed steel knows and appreciates the troubles and difficultics that may sometimes arise in the heat-treating of this product. The manufacturer's aim is to make a uniform high-speed steel which will best meet the requirements of the average machine shop on general work, and at the same time allow the widest variation in heat-treatment to give desired results.

High-speed steel is one of the most complex, complicated alloys known. A representative high-speed steel contains approximately twenty-four per cent. of alloying metals, namely: Tungsten, chromium, vanadium, silicon, manganese, and in addition there is often found Cobalt, molybdenum, uranium, nickel, tin, copper and arsenic.

The selection of a standard analysis by the manufacturer is the result of a series of compromises between various properties imparted to the steel by the addition of different elements. There is a wide range of chemical analyses of various brands of high-speed steel. You will agree that, although there are being manufactured as high-speed steel, brands that do not come within the standard of what is commercially known as high-speed steel, there are certain well-defined limits to the contents of certain elements.

The steel, to be within the range of generally accepted analysis should contain over 16 per cent. and under 20 per cent. tungsten. If of lower tungsten content it should carry proportionately more chromium and vanadium.

Further discussion in this paper is confined to high-speed steels containing approximately 18 per cent. tungsten.

The combined action of tungsten and chromium in steel gives to it the remarkable property of maintaining its cutting edge at relatively high temperature. This property is commonly spoken of as "red-hardness." The percentage of tungsten and chromium present should bear a definite relationship to each other. Chromium imparts to steel a hardening property similar to that given by carbon, although to a less degree. The hardness imparted to steel by chromium is accompanied by brittleness. The chromium content should be between 3½ and 5 per cent.

The Introduction of Vanadium

Vanadium was first introduced in high-speed steel as a "scavenger," thereby producing a more homogeneous product of greater density and physical strength. It soon became evident that vanadium used in larger quantities than necessary as a scavenger imparted to high-speed steel a much greater cutting efficiency. Recently, no less an authority than Professor J. O. Arnold, of the University of Sheffield, England, stated that "high-speed steels containing vanadium have a mean efficiency of 108.6, as against a mean efficiency of 61.9 obtained from high-speed steel without vanadium content." A wide range of vanadium content in high-speed steel, from ½ to 1¼ per cent. is permissible.

An ideal analysis for high-speed steel containing 18 per cent. tungsten is a chromium content of approximately 3.85 pr cent.; vanadium .85 per cent. to 1.10 per cent., and carbon, between .62 and .77 per cent.

Sulphur and phosphorus are two elements known to be detrimental to all steels. Sulphur causes "red-shortness,"

and phosphorus causes "cold shortness." The detrimental effect of these two elements counteract each other to some extent but the content should be not over .02 sulphur and .02% phosphorus. The serious detrimental effect of small quantities of sulphur and phosphorus is due to their not being uniformly distributed owing to their tendency to segregate.

The contents of manganese and silicon are relatively unimportant in the percentage usually found in high-speed steel.

The detrimental effects of tin, copper and arsenic are not generally realized by the trade. Small quantities of these impurities are exceedingly harmful. These elements are very seldom determined in customers' chemical laboratories and are somewhat difficult for public chemists to analyze for.

In justice to the manufacturer of high-speed steel, attention should be called to the variation in chemical analyses between the best of laboratories. Generally speaking, a steel works laboratory will obtain results much finer and more accurate than is possible by a customer's laboratory, or public chemist. This can reasonably be expected, for the steel works' chemist is a specialist, analyzing the same material for the same elements day in and day out.

The importance of the chemical laboratory to a tool steel plant cannot be overestimated. Every heat of steel is analyzed for each element, and check analyses obtained; also, every substance used in the mix is analyzed for all impurities. The importance of using pure base materials is known to all manufacturers despite chemical evidence that certain detrimental elements are removed in the process of manufacture.

The chemical composition of steel for any purpose is a basic consideration and must be such as will meet the requirements, but the quality of the steel does not depend wholly upon the chemical composition. Assuming the chemical composition to be within the permissible limits, the quality depends upon local conditions surrounding its manufacture. If the quality of steel were entirely dependent upon the chemical composition and not influenced by its "working" and "handling" in accordance with tool steel practice, the tool steel industry would be unable to exist.

The manufacture of high-speed steel represents the highest art in the making of steel by tool steel practice. Some may say, on account of our increased knowledge of chemistry and metallurgy that the making of high-speed steel has ceased to be an art, but has become a science. It is, in fact, an art, aided by science. The human element in the manufacture of high-speed is a decided factor, as will be brought out in the following remarks.

The Selection of Raw Material

The manufacture of high-speed steel begins with the selection of the raw materials which enter into the mix. Reference has already been made to the care taken by having a chemical determination made of all impurities likely to be present in ferro-alloys and also the fact that in order to make a good product, a good low-phosphorous melting iron must be used as the base.

The heat-treatment of steel in its broad aspect may be said to commence with the melting furnace and end with the hardening and tempering of the finished product. High-speed steel is melted by two general types of furnace, known as crucible and electric; the process of operation and construction of which have been completely described in papers delivered before this and other societies. Steel treaters are more vitally interested in the changes that take place in the steel during the various processes of manufacture, rather than a detailed description of these processes, which are more or less familiar to all.

The importance of properly melting high-speed steel is known and recognized by all informed on the subject, but it is not my intention to go into this important subject in this paper.

It must be of correct chemical analysis, properly melted and cast into solid ingots, free from blow-holes and surface defects. Sudden changes of temperature in high-speed steel are to be guarded against at every stage of its manufacture and subsequent treatment. Ingots of high-speed steel are relatively weak, and the tendency to crack, due to cooling strains, is great. For this reason the hot ingots are not allowed to cool quickly, but are placed in furnaces which are of about the same temperature and are allowed to cool gradually before being placed in stock. Good high-speed steel can be made only from good ingots.

Steel treaters should be more vitally interested in the important changes which take place in highspeed steel during the hammering operations than that of any other working the steel receives in the course of its manufacture.

The quality of high-speed steel is dependent to a very great extent upon its structure. I want it understood that by further reference to "structure" of high-speed steel I mean the appearance of a polished and etched specimen under the microscope. By "fracture" will be meant the appearance of the broken surface of a bar or billet to the naked eye. The making of the structure begins under the hammer, and the beneficial effects produced in this stage persist through the subsequent operations, providing they are properly carried out. The massive carbides and tungstides present in the ingot are broken down and uniformly distributed throughout the billet.

To accomplish this the reduction in area must be sufficient and the hammer blows should be heavy, so as to cause compression into the centre of the billet; otherwise undesirable characteristics such as coarse structure and Carbide envelopes will exist and cause the steel treater much trouble. Surface defects invisible in the ingot may be opened up under the hammering operation, in which event they are clipped from the hot billet.

Generally speaking, it may be said that high speed steel of good quality works well under the hammer. Ingots are first hammered into billets. These billets are carefully inspected and all surface defects ground or chipped. The hammered billets are again slowly heated and receive a second hammering, known as "cogging." The billet resulting therefrom is known as a "cogged" billet and is of the proper size for the rolling mill or for the finishing hammer.

Although it is not considered good mill practice, some manufacturers who have a large rolling mill perform the very important cogging operation in the rolling mill instead of under the hammer. Cogging in a rolling mill does not break up and distribute the Carbides and Tungstides as efficiently as cogging under the hammer; another objection to cogging in the rolling mill is that there is no opportunity to clip surface defects developed as they can be under the trained eye of a hammer-man, thereby eliminating such defects in the finished billet.

The Rolling of High Speed Steel

The rolling of high speed steel is an art known to very few. The various factors governing the proper rolling of high speed steel are so numerous that it is necessary for each individual rolling mill to work out a practice that gives the best results upon the particular analysis of high speed steel they make. Important elements entering into the rolling of high speed steel are the heating and finishing temperatures, draft, and speed of the mill. In all of these the element of time must be considered. There is no department of a tool steel plant where the personnel of the actual operators has a greater influence upon the quality of the finished product.

High speed steel should be delivered from the rolling mill to the annealing department free from scale, for scale promotes the formation of a decarbonized surface. In preparation of bars of high speed steel for annealing, the bars are packed in tubes with a mixture of charcoal, lime and other material. The tube is sealed and packed in the annealing furnace. The temperature of the furnace is gradually raised to about 1,650° F. and there held for a sufficient length of time, depending upon the size of the bars. After very slow cooling the bars are removed from the tube. They should then show a Brinnell number of between 235 and 275.

The inspection department of a high speed mill ranks with the chemical and metallurgical departments in safeguarding the quality of the manufacturer's product. They inspect all finished material from the standpoint of surface defects, hardness, size and fracture. They reject such steel as is judged not to meet the manufacturer's standard. The inspection and metallurgical departments work hand-in-hand, and if any department is not functioning properly it will soon become evident to the inspectors, enabling the management to remedy the trouble.

The successful manufacture of high speed steel can only be obtained by those companies who become specialists. The art and skill necessary in the successful working of such steel can be attained

pervision of experts. To become an expert operator in any department of its manufacture, it is necessary that the operator work almost constantly at the production of such steel.

As to the heat-treatment of high speed steel, it is customary for the manufacturer to recommend to the user a procedure that will give to his steel a high degree of cutting efficiency. The recommendations of the manufacturer should be conservative, embracing fairly wide limits, as the tendency of the user is to adhere very closely to the manufacturer's recommendations. Unless one of the manufacturer's expert service men has made a detailed study of the customer's problem, the manufacturer is not justified in laying down set rules, for if the customer does a little experimenting he can probably modify the practice so as to produce results that are particularly well adapted to his line of work.

The purpose of heat treating high speed steel is to produce a tool that will cut so as to give maximum productive efficiency. This cutting efficiency depends upon the thermal stability of the complex hardenites existing in the hardened and tempered high speed steel. The writer finds it extremely difficult to convey the meaning of the word "hardenite" to those that do not have a clear conception of the term. The complex hardenites in high speed steel may be described as that form of solid solution which gives to high speed steel its cuting efficiency. The complex hardenites in high speed steel are produced by heating the steel to a very high temperature, near the melting point, which throws into solution Carbides and Tungstides, provided they have been properly broken up in the hammering process and uniformly distributed throughout the steel. By quenching the steel at correct temperature this solid solution is retained at atmospheric temperature.

It is not the writer's intention to make any definite recommendations as to the heat-treating of high speed steel by the users. It is recognized that such steel can be heat-treated to give satisfactory results by different methods. It is, however, believed that the American practice of hardening and tempering high speed steel is becoming more uniform. This is due largely to the exchange of opinions in meetings such as this. The trend of American practice for hardening high speed steel is towards the following:

First: Slowly and carefully pre-heat the tool to a temperature of approximately 1,500° F., taking care to prevent the formation of excessive scale.

Second: Transfer to a furnace, the temperature of which is approximately 2,250° to 2,400° F., and allow to remain in the furnace until the tool is heated uniformly to the above temperature.

Third: Cool rapidly in oil, dry air blast, or lead bath.

Fourth: Draw back to a temperature to meet the physical requirements of the tool, and allow to cool in air.

The desirability of drawing hardened high speed steel to a temperature of 1,100° F. was pointed out, and it is indeed encouraging to learn that comparatively few treaters of high speed steel have failed to make use of this fact. Many steel treaters at first contended that the steel would be soft after drawing to this temperature and it is only recently, since numerous actual tests have demonstrated its value, that the old prejudice has been eliminated.

With an understanding of some of the difficulties inherent in the manufacture of high speed steel, I will try to give you the justification of some of the trade practices and customers which have been generally accepted.

First: SHOULD THE CUSTOMER SPECIFY BY WHAT PROCESS TOOL STEEL IS TO BE MADE?

The customer should not specify by what process tool steel is to be made. The customer is more concerned as to the quality of the tool steel and the service which it gives him. It should be left to the manufacturer to use the process which, in his opinion, produces the most satisfactory product. The customer has a right to know by what process the steel furnished him is made.

Second: SHOULD CUSTOMER SPECIFY ANY LIMITS AS TO CHEMICAL COMPOSITION OF HIGH SPEED STEEL?

The customer should not specify any limits as to the composition of high speed steel. A manufacturer should be willing to co-operate with the trade to the extent of submitting to them his rejection limits of those elements vitally affecting the efficiency of the steel.

Third: WHY SHOULD HIGH SPEED STEEL BE DELIVERED ONLY IN THE ANNEALED CONDITION?

High speed steel should be delivered only in the annealed condition because annealing relieves the internal strain inevitable in the manufacture and puts it in vastly improved physical condition. The manufacturer's inspection after annealing also discloses defects not visible in the unannealed state.

Fourth: IT IS ADVANTAGEOUS FOR THE BUYER TO CONDUCT A TEST ON VARIOUS BRANDS OF HIGH SPEED STEEL BEFORE DECIDING UPON PLACING HIS CONTRACT?

The only true test for a brand of high speed steel is the service that it gives by continued performance month in and month out under actual shop conditions. The average buyer of high speed steel is not justified in conducting a test, but can well continue to purchase his requirements of high speed from a reputable manufacturer of a brand that is nationally known. The manufacturer of high speed steel is always willing to cooperate with the trade in the conducting of a test and is much interested in the information received from a well conducted test. A test of high speed steel, to be valuable, should be conducted in a manner as nearly approaching actual working conditions in the plant in which [illegible] made, as is practical. In conducting a test a few reputable brands of high speed steel should be allowed to [illegible] test should be conducted [illegible] and down by customer and all competitors should be treated equally. All tools entered should be of exactly the same size and shape. There is much difference of opinion as to the best practical method of conducting a test, and [illegible] as to how the test should be conducted should be left to the customer, who should co-operate with the manufacturers in devising a test which would give the best basis for conclusions as to how the particular brands of high speed steel would perform under actual shop conditions.

Fifth: WHAT IS THE VALUE OF TESTING FINISHED TOOLS WITH A FILE? CAN SUCH A TEST BE CONSIDERED RELIABLE?

The value of the file test depends upon the quality of the file and the intelligence and experience of the person using it. The file test is not reliable, but in the hands of an experienced operator, gives some valuable information. The manufacturer of small tools from high [illegible] carries the file test to extremes. Almost every steel treater knows of numerous instances where a lathe tool which could be touched with a file has shown wonderful results as to cutting efficiency.

Sixth. SHOULD SPECIAL LENGTH BARS BE SPECIFIED, OR SHOULD BARS BE OF ORDINARY COMMERCIAL LENGTH? SHOULD IT BE PERMISSIBLE TO DELIVER SHORT BARS?

The customer should not specify special length bars unless for special requirements. The manufacturer should reserve the right to ship bars of commercial length and should also be permitted to deliver short bars. That these conditions are necessary in high speed steel is due to the rejection under final inspection. A physical defect may be found in the middle of finished bar, which must be eliminated. This results in there being finished, two short bars of approximately four or five feet long in place of the usual commercial length, approximately ten feet. For the customer not to permit delivery of short bars would result in excessive, inexcusable waste. Commercially, a bar of standard size should be considered approximately ten feet long, and the manufacturer should have the right to ship the equivalent number of feet, including a percentage of short bars. 24 inches should be the minimum length acceptable to purchaser, and delivery of pieces of this short length should only constitute a small percentage of the quantity furnished. It would be very desirable if the trade would cooperate by giving to the manufacturer multiple lengths to which to work whenever practical. Much loss would be avoided by this co-operation.

Seventh: WHAT DEVIATION IN PERCENTAGES OF WEIGHT OF HIGH SPEED ORDERED SHOULD THE MANUFACTURER BE PERMITTED?

A manufacturer should at all times ship as close to weight as possible without cutting bar to length. A maximum limit of 10 per cent. over or under should be allowed.

Eighth: ARE THE MANUFACTURER'S TERMS OF WARRANTY JUSTIFIED?

The terms of warranty almost universally adopted, with slight variations are as follows: "We will replace or allow credit for any steel which, if properly selected and used, shall prove defective, but we will not allow claims for labor or damage." The universal acceptance of these terms by the buying public would prove their justification. There is no stronger or more equitable form of guarantee in any line of business.

Ninth: WHAT ALLOWANCE SHOULD BE MADE BY BUYER FOR DECARBONIZATION?

The manufacture of high speed steel has progressed to such a point that buyers, in placing their specifications, barely consider allowance for decarbonization. The allowance made by the buyer should be governed by his experience with the brand of high speed steel, and in all cases should be liberal.

Tenth: IN WHAT MANNER SHOULD A CUSTOMER WHO HAS A COMPLAINT AS TO QUALITY OF HIGH SPEED STEEL CO-OPERATE WITH THE MANUFACTURER?

A buyer should invariably ask permission of the manufacturer to return steel claimed defective, or give the manufacturer an opportunity of having one of his experienced service men inspect and examine material claimed defective at his plant. The customer should co-operate with the manufacturer to the extent of giving the manufacturer all information available regarding the details of shipment, order number under which it was shipped, date and time of receipt. This information not only enables the manufacturer to identify the material in question as his own, but gives him an opportunity of investigating the handling of the order in his own plant, and in a well organized tool steel plant it will enable the manufacturer to determine the heat number from which the steel in question was rolled, its analysis, and other valuable data concerning its working through the mill. It is only by carefully following customer's complaints that the manufacturer is able to correct faults and improve his product.

Eleventh: IS THE MANUFACTURER'S MAINTAINING OF EXPERIENCED SERVICE MEN TO HELP SOLVE CUSTOMER'S HEAT-TREATING PROBLEMS AND SECURE FOR THEM MAXIMUM EFFICIENCY AND PRODUCTION JUSTIFIED?

There is no expense incident to the manufacturing, selling and use of high speed steel which has justified itself in actual practice more than the maintaining of an adequate, competent corps of service men. The cost of the very best high speed steel is infinitesimal compared with the value of the finished tool in constant daily service. High speed steel is to-day marketed upon the basis of quality and service. The maintaining of a competent corps of experienced service men helps the manufacturer as nothing else could in maintaining and constantly improving the quality of his product. The assurance given to the buyer by a reputable maker of high speed steel that their service department will stand back of their product is well worth the extra expense.

Twelfth: IS THE PRACTICE OF BUYING HIGH SPEED STEEL BY BRAND NAMES INSTEAD OF PHYSICAL, CHEMICAL AND METALLURGICAL SPECIFICATIONS JUSTIFIABLE?

The practice of buying high speed steel by brand names is justifiable. The guarantee behind high speed steel is the standing and reputation of the manufacturer, who should maintain in his employ metallurgists and experienced service men who will defend the quality of his product and be ready at any time to heat-treat and demonstrate to buyer's satisfaction that the product furnished by him will meet any of his reasonable requirements. The customer's specifying the chemical, physical or metallurgical properties relieves the manufacturer of his responsibility as to quality. Quality is not dependent upon the chemical composition and poor high speed steel can be made within any limits of chemical contents that could be commercially met by a manufacturer of best quality high speed steel. In purchasing high speed steel by brand name the buyer places responsibility for performance clearly with the manufacturer. The specifying of physical, chemical or metallurgical limits by buyer would lead to endless controversy and would positively retard, in fact, completely arrest the progress of the industry.

The manufacturers of high speed steel should co-operate with the members of the American Steel Treaters' Society to the extent of submitting upon request rejection limits as to chemical content of those elements which vitally affect the Steel Treater's work. It is not desirable that the manufacturer's rejection limits be published broadcast. The buyer has the right to demand that high speed steel purchased by him should be within the generally accepted analysis of high speed steel. Chemical composition is a basic consideration, but the quality is dependent upon many other factors, the most important of which is the human element. No steel treater can question the fact that the results obtained from heat-treating depend upon the operator. The operator will use all modern appliances, such as pyrometer, automatic temperature control, quenching machines, etc., but the results obtained depend upon his individual experience and skill. The manufacture of tool steel is and will continue to be a handicraft industry.

Modern tool steel practice has changed from that of the past, not by the use of labor-saving machinery, but by the use of scientific devices which aid and guide the skilled craftsman in producing a steel of higher quality and greater uniformity. It is upon the intelligence, experience and skill of the individual that quality of tool steel depends.

THRUST COLLAR JIG

(Concluded from page 563)

The next operation is to bore and finish to thickness. This is done on a Warner & Swasey machine and is held by a special face plate, Fig. 6, which is made from cast iron with two steel blocks, O and P. These blocks are bored for locating pins Q, then fitted to face plate and ground on face R, so that the collar will be perfectly centred after dropping the locating pins in the yoke pin holes, S and T. To remove collar from face plate all that is required is to slacken clamps shown at Fig. 8, then lift the locating pin Q, which is shown at Fig. 7, the tension of the spring U, Fig. 6, being held by the small pin resting on the periphery of the face plate.

At Issoudan, France, was located America's greatest aviation school abroad. Just before the end of the war, two engineer officers, walking down the principal street, passed three doughboys. None of the three saluted. The younger of the officers grew purple.

"What do you mean by not saluting an officer?" he exploded.

They made no reply at first, and then the more composed of the trio said, "Beg pardon, sir, but we thought you were in the air service."

A novel method of testing automobile tires is employed by a manufacturing tire concern in Denver.

The track is half a mile in circumference, and it represents every feature of good and bad roads. An ingenious machine, with a long arm to which the tire is attached, propels the tire around the track.

A weight equivalent to that of a heavily loaded automobile is suspended over the tire in such a way that the tire itself carries the load. Once started on its journey, the tire continues to roll until it has given up its maximum amount of mileage.

He was a very small boy. Paddy was his dog, and Paddy was nearer to his heart than anything on earth. When Paddy met swift and hideous death on the turnpike road the boy's mother trembled to break the news. But it had to be, and when he came home from school she told him simply:

"Paddy has been run over and killed."

He took it very quietly. All day it was the same. But five minutes after he had gone to bed there echoed through the house a shrill and sudden lamentation. His mother rushed upstairs with solicitude and pity.

"Nurse says," he sobbed, "that Paddy has been run over and killed."

"But, dear, I told you that at dinner, and you didn't seem to be troubled at all."

"No; but—but I didn't know you said Paddy. I—I thought you said daddy!" —Montreal Journal of Commerce.

How Many Accidents Constitute a Warning?

When You See Some Fellows Hurt in the Shop, Do You Ever Stop to Think if the Cause of the Accident Can be Removed? Prevention is Better Than Cure

By J. H. M.

WE are now living in the age of "safety first." Should this statement be doubted, all one need do is look about him. Here, there, and everywhere we see miscellaneous warnings fairly shrieking out their messages. Street cars, level crossings, factories, and even the daily papers are havens of refuge for such solemn warnings as: "Watch Your Step," "Be Careful," etc., etc.

We are warned of this and warned of that, cautioned to tread carefully at every turn, and still there are accidents.

Granted that the number of these accidents has depreciated to a great extent —and that a large percentage of the remainder can be traced to carelessness, yet the point is this, that in spite of repeated warnings, people will persist in forgetting, and with serious results.

We must admit, however, that in many cases the preventive goes no further than a plastering of the scenery with cards bearing the well-known slogan, "Safety First." This is not safeguarding, but plain downright foolishness. You cannot save anyone from accident by warning only, you must get deeper into the subject, finding out how and why accidents occur. The very words "Safety First" have a deep meaning if one cares to study them. They apply to the owner of a plant just as much as they do to the employee. For example, if the owner of a plant allows such signs to be placed in his plant he must believe in the value of safety. The plant engineer, or superintendent, as the case may be, must also believe in safety, otherwise he would raise an argument regarding the placing of signs throughout the plant, which brings us to the point we are aiming at, namely, that equal responsibility should be shared by all.

Owners and executives should get together for discussion purposes, take periodical visits through their plants, looking for possibilities for safeguarding in a practical manner. It may be only an uncovered gear, an overhead belt, or some apparently simple matter that needs attention. Wherever possible, any moving part of machinery should be protected.

Makers of up-to-date machinery are realizing this truth more and more as time goes on, for the machine tool of to-day is a much better guarded tool than one made even a few years ago.

It would be impossible in a short article of this nature to touch on all the danger points to look out for. Each industry has its own particular dangers, and plant executives must acquaint themselves with these pitfalls before the placarded warnings can hope to have any effect. Workmen as a rule do not take kindly to these cards and consider them wasted money at any time, but this is especially true where danger cards are plastered all over, while moving parts, gears, pulleys, belts, and so on are all deliberately left exposed for the workmen to catch their clothing on.

Readers might be inclined to doubt the existence of such conditions, so, for illustrative purposes two incidents, each of them true, are here related to bear out the above contention.

In a certain machine shop plant at Ottawa, the writer entering the shop "gathered" that this plant at least believed in the safety idea. Cards were plastered everywhere, both in the English and French language. This was encouraging, so he looked further and discovered that all the countershaft collars were equipped with safety setscrews. Again he felt impressed, when suddenly a horrible shout went up from one end of the room, and a general rush of workmen in that direction was the next move. Of course the writer was on the job quickly and found that the trouble was with a radial drill. The operator had broken his arm.

On investigation it was found that his smock had caught on a protruding common or garden variety setscrew and broken his arm. The writer also found that it had been the third time that month that this operator had been caught in this way. In the former two cases he had luckily escaped injury, but the third case proved to be the finishing point.

It is this point which prompted the heading of this article, "How Many Accidents Constitute a Warning?"

Here was a plant using safety setscrews in their countershafts and yet allowing the dangerous type of screw to be used in a place far more dangerous than any countershaft.

The writer on leaving this plant decided that on entering the next shop on his calls he would look at the radial drills there, when, imagine his surprise to find exactly the same conditions. A similar setscrew was used on the main drill spindle to hold certain large sized drills in a home-made chuck.

Are all plants in similar danger? Luckily we can say no, for it has been the writer's pleasure to see drills properly safeguarded in every way in many a plant.

To proceed to the second and last story. This tale concerns a flour mill, which had a separator so placed that the workmen, in passing, had to be careful of exposed gearing. To ensure (?) the workmen being careful a warning sign was placed just beside these gears. In spite of this sign, men would forget, and have some piece of clothing ripped and torn. This went on for years with an average of one man every month forgetting himself and tearing clothing.

No serious accidents occurred, so no guard went up. One day, however, one of the sons of the owner of this mill went on a tour of investigation. In passing this danger point his foot slipped, caught in the gearing, and crushed both his foot and leg. As he fell he also received other injuries which resulted in his death. Of course a suitable guard was afterwards designed, but at what a cost.

We tell this tale, not for the love of repeating a gruesome story, but to impress readers with the necessity of cooperation between employer and employee. Safety signs are all very well in their way, but they must be backed up by intelligent safeguarding of machinery in general.

According to the preliminary report on the water power resources in India, drawn up by Mr. J. W. Meares, M.Inst. C.E., Chief Engineer, Hydro-Electric Survey, India's industries now absorb a matter of over a million horse-power, of which only some 285,000 is supplied by electricity from steam, oil, or water. The water power so far actually in sight amounts to 1¾ million horse-power, but this excludes practically all the great rivers at present uninvestigated. Thus it is stated that the minimum flow of the seven great rivers eastward from the Indus are capable of giving no less than three million horse-power for every thousand feet of their fall from the Himalayas, while similar considerations apply to rivers in other parts. Some doubt, however, is expressed as to the estimate of seven million horse-power in the Irrawaddy and Chindwin Rivers, given in the report of the Conjoint Board of Scientific Societies.

Recently a workman at Pablo Beach, Fla., found a whale measuring 47 ft. 3 in. in length. The monster had been washed ashore and was dead, wounds indicating a ship had struck it, or it had been attacked by sharks. It is said that it was of the arctic or Greenland variety of whale, which when full-grown attains a length of 45 to 50 ft. Since these whales seldom venture beyond the southern limit of drift ice, it probably met with death in nothern waters.



WELDING AND CUTTING



Oxy-Acetylene's Possibilities in Heavy Welding

By J. G. HILL

THE subject of "Possibilities of Oxy-Acetylene in Heavy Welding" is an extremely important one and should be considered by every one in the industry. We are all familiar with the many applications of oxy-acetylene in production work, but how many realize the work that is being done on heavy reclamation work?

It might be well to cite a few of the larger cases. Within the past year three steel plants in the Youngstown district have been able to operate due to repairs by oxy-acetylene on blowing engine cylinders where the fractures measured from twenty to forty feet in three inch thick material and where the welding was continuous for 48 to 64 hours. The time saved on this work was three to six months over the time required for replacement, and the cost of repairs was less than the cost of three hours' shutdown.

During the war rush the frame of a bull-dozer for piercing shell forgings broke. The frame weighed seventy tons and would have required at least 40 days to replace. A section 18 inches by 40 inches was welded and the machine was out of operation just 48 hours.

Another application, which was really a wonderful repair, was made on the furnace of a steel plant, where the rivets sheared off on the circumferential seam, allowing the furnace, 80 feet in height, to sag on one side. The entire side was packed into place and the leading seam was welded and the furnace running in a remarkably short time.

The cases cited may seem like extreme ones, but such is not the case, for in our own shop for the past two weeks we have handled 16 hammer housings for forging hammers weighing 2 to 4 tons each, 3 steam hammer cylinders of 3 tons each; 1 bull-dozer frame, 3 tons; 1 engine bed, 6 tons, all in one shop during such a short time for repairs by oxy-acetylene. I believe that the heavy work is really just beginning; for instance, half of the castings mentioned above were from concerns that had never had a large casting welded before; if the work done is successful, which we certainly think it is, figure the increased market for heavy welding built up in this short time.

The supervision and inspection on this class of repairs must be far more strict than on ordinary welding job work as one failure will often put the process in bad standing for all time with a customer. I know of one who had not less than 500 heavy welding jobs, where the management prohibited welding for nearly four months because a very important machine was ruined by careless work. He overlooked entirely the good work that had been done prior to the mishap, and only by a change in his office was he "lined up" again.

While the jobs that have been described have been mostly in cast iron, I do not wish to leave the impression that steel work is not in our line for that is not the case. There is a fine example of this class of work in the nitrate plant equipment where many heavy steel welds were made successfully and, in the cases with which I am familiar, were superior to other methods of welding.

A Chicago concern recently welded some converters 11½ feet long by 30 inches in diameter, having 1½ inch plate heads. Although engineers and boiler experts had said it could not be done, and electric welders had taken their word for it, the welding work was remarkably successful. This is a good example of one place where the electric process can be beaten. A galvanizing pot is another place where the results obtained by oxy-acetylene have been superior to other processes as the gas method does not leave the porosity common to the others and cause the work to fail.

An interesting feature of heavy welding which we are doing is the repair of large castings which cannot be removed and preheated in the regular way. For example, the top flange of a low pressure cylinder on a lake vessel cracked through at one of the steam ports while the ship was on a trip. The removal of this cylinder meant tearing out part of the cabin and deck, and to preheat it meant a possible fire and worse fracture, so a screw jack was used to expand the cylinder mechanically, and by a little local heating with welding torches this casting was welded and is now in its second season of service.

Most shops are familiar with sidehand and overhead welding in steel, but cast iron welding has been considered impossible except on a nearly horizontal plane. I believe that practically any first-class shop will now weld cast iron for you in a perpendicular position, and give you a first-class job, too. While it is not recommended to do work in this position there are places on extremely heavy castings, especially when the crane equipment is insufficient, where this advance in the welder's art is very valuable.

While I do not believe that shops in general are in favor of welding large crank shafts, I believe that this field deserves a lot of experiment, as the call for this class of repairs is growing every day.

The steel mills offer another large field for heavy welding in the reclaiming of wabbler rolls. It has been the experience of most of the mills that the welded ends outwear the original ends in nearly every instance. Another heavy repair which has come to the market in the near past is welding rubber plant calender rolls. The difficulty with this job was in holding the alignment, but this has been well handled, and many shops are now doing this particular work.

With all the good work we are doing we should not overlook the bad. I believe that most shop men will agree with me that the absolutely worthless work that is being done by many people on boilers with oxy-acetylene and other processes leaves a field for the greatest improvement in the use of the process. In many districts th inspectors are prohibiting welding on boilers, and when you see some of the work that has been done you cannot be surprised. It is here, I believe, that the greatest possibility for heavy welding exists; it is profitable work, and there is a lot of it. In turning out better welders, the welding schools are helping, and the manufacturers are helping by their booklets, but unfortunately the real boiler welders are still very few.

It is interesting to note along this line that the heads of four large tank and boiler plants have stated to me recently that they have been forced to turn to welding to compete with others who have been using oxy-acetylene in their shop practice and that more than half of their inquiries specify welded tanks, or, if not specified, ask for prices on the welded product. When we consider that boiler makers have been very antagonistic towards welding, we must not overlook this condition, which speaks

*Paper read by Mr. J. C. Hill, of the Great Lakes Welding Co., Cleveland, Ohio, before the convention of the International Acetylene Association, New York City, July 15, 16, 17, 1919.

well for the purposes of the present.

Locomotive frame welding has been the pet of the theoretical people, but I can honestly say that frames have been welded by oxy-acetylene in much less time and at a lower cost than with Thermit, and to my mind as satisfactorily if not more so.

A point concerning heavy welding which has been brought to my attention by several large customers is the fact that so many shops, which really do fine work, as far as the welding goes, send out their work with the slag and flux adhering to the castings, leaving a very rough looking job. I think that we all can possibly pay a little more attention to cleaning up the work, and it will have its effect with the customer.

Naturally the increased sales of apparatus to the various industries throughout the country cuts down the amount of small repair work materially for the jobbing shops, but these industries do not do the heavy work, and they never will. The shops that are to stay and continue to be successful must go after the big work, for there is lots of it.

THE AUTOGENOUS WELDING OF RAILS

There have already been published articles on the welding of railway rails, and it is one of the big problems in railroad work. The present practice of bolting rails together has two disadvantages; first the [illegible] of the engagement [illegible] which is the cause of a great deal of the fatigue noticeable in the metals used for railway coaches and locomotives, and, second, there is the [illegible] of the passengers' comfort. There has been a constant effort made to provide a continuous or as nearly continuous rail as possible and oxy-acetylene, electric and thermit welding [illegible] and tried in the past.

Professor C. F. Keel, director of the Swiss Acetylene Society, has published during the war, a brochure on the subject giving the results of tests made on welded joints and describing a new method of making the welded joint.

There is given below an abstract of the article.

In Switzerland because of the many tunnels and bridges, the matter of a continuous rail is important, because of the otherwise continuous shock given to the structure by joints. The railways have sought to minimize these shocks by making the rails as long as possible, some rails in use being [illegible] 100 feet.

The process of rail welding proposed by Professor Keel is as follows:

The base of the rail is welded and the head but the upright section is cut out by means of the torch. It is proposed to use as well the ordinary fish plates as used at present to assist in maintaining the alignment of the rails. In the past considerable difficulty has been encountered in preserving the alignment of rails welded through the upright section, but in the present process no such difficulty is encountered. In the case of rails already laid, the author recommends that [illegible] first and then the head, but if practicable, it is far more advisable to turn the rail over and weld the base from the bottom side in order that the weld may be larger. The base section, of course, is subjected by the passage of trains to a greater strain than the head section and the weld must be made with the greatest care.

For a welding rod, Prof. Keel proposes to use [illegible] of the rail as possible. Swedish steel has been used and tests have shown that weld is always softer than the metal of the rail. The welding rods used contained some silicon and some manganese. A flux with a base of sodium carbonate and sodium bicarbonate has been used. Hammering increases the hardness or denseness of the weld. The weld on the [illegible] is hammered when the weld is finished and while still red, the head section is hammered first when the weld is one-half completed and after the completion.

On the subject of the cost of the work, the edges were beveled by the torch and the upright section was cut out by the torch which increased the costs of performing the work. 300 to 400 litres (10.5 to 14 cu. ft.) of oxygen and 150 to 200 litres (5.25 to 7 cu. ft.) of acetylene were used for each [illegible] beveling each joint. If the work of welding was carried out in a shop the consumption of oxygen would be 1,200 litres (42 cu. ft.) and of acetylene 900 litres (31.5 cu. ft.); if carried out in the open air the consumption would be increased to 1,600 litres (56 cu. ft.) of oxygen and 1,200 litres (42 cu. ft.) of acetylene. One hour to one hour and one-half is required per joint made, one-third of the time is required for preparing the joint and two-thirds for the actual welding. The author suggests as a possibility of cutting down the cost the use of a preheating torch. Professor Keel also advocates the bonding of rails by welding, he makes use of an iron wire of appropriate diameter, to each end of which is fixed a plug. This plug is inserted in a hole provided in the upright section of the rail and the bond is welded in place.

Revue de la Soudure Autogene (Paris).

EVOLUTION OF THE "TANK"

Entirely new problems were involved in the development of the "Tank," as described by Sir Eustace Tennyson d'Eyncourt in his paper before the British Association.

The conditions laid down by the War Office were that the machine had to be capable of crossing gaps at least 5 ft. wide; to carry fuel and water for at least twenty miles; and be able to negotiate parapets five feet thick and 5 ft. high, having an exterior slope of 1 in 1. Weight was limited by the strength of bridges to be crossed; and the dimensions were restricted by the carrying capacity of British railway trucks and by the British and French loading gauges. The machine had to be strong enough to bear the strains to which it would be subjected, and at the same time only exert a moderate pressure per sq. in. on the ground. Further requisites were that it had to be habitable and well ventilated; it had also to be bullet-proof; it must be easily and quickly constructed, using reliable engines and other parts which could be readily produced in bulk after standardization. The combination of these essentials in a machine, which had also to be a low and inconspicuous object, proved a very difficult problem.

It became clear, in working out the general form, that the best plan would be to adopt the naval idea of sponsons on each side of the machine, each sponson carrying a gun, which was thus situated about the middle of the tank between the tracks. It was this which gave the contour to the No. 1 tank, known as "Mother," and also as "Big Willie," to distinguish it from "Little Willie." "Little Willie" was fitted with tracks obtained from America, and had an armored body with a turret mounted at the top. The American track was found to be not nearly substantial enough to stand the strain of the heavy body, armament, etc. It was therefore necessary to design a completely new form of track, and this form was developed and used for the first completed machine.

The author details the process of evolution from Mark I to Mark II and Mark III. In the later machines, the aim was to use a more powerful prime mover than the 105 h.p. Daimler engine, which was originally fitted in all cases. In the Mark V type increased power was given by a six-cylinder Ricardo engine of 150 h.p., and a special epicyclic gear was introduced. The Williams-Janney variable speed gear was provided in later types, to be in turn succeeded by an improved form of epicyclic gearing.

When the need arose for a lighter tank, carrying a smaller armament and crew, the "Whippet" was designed. Increased speed was obtained by materially reducing the weight of the machine, which was only 14 tons, as compared with 28 tons of the previous types. Two independent sets of engines and transmission gears were used, each track being driven independently. The engines were of the Taylor four-cylinder type, each giving 45 h.p. These were connected by cone clutches to gear-boxes of the constant mesh type, giving four speeds forward and one reverse, and driving through worm reduction gears to chain drives, direct to the track sprockets. Steering was effected by running one engine faster than the other, or disconnecting it by one of the clutches.

During the last phase of the war, the Mark VIII type was evolved, in conjunction with the United States. Mark VIII. was somewhat larger than any of its predecessors. Except that the engines were placed in an entirely separate compartment, the design was generally similar to that of Mark V, with two 6-pounders in sponsons which were arranged to hinge inboard for transportation. Some time was absorbed in developing the Liberty engine to make it suitable for the Mark VIII tank.



WHAT OUR READERS THINK AND DO



BAYONET LOCK FOR JIGS AND FIXTURES

By ROBERT MAWSON

I had a problem when designing a fixture a short time ago that was solved in a simple and easy manner by the bayonet lock-holding device, shown in the illustration.

The surface of the casting against which I desired to exert the pressure is shown by the line A. At the lower surface of the casting being machined was a flange B, which was about 1¼ inches nearer the wall of the fixture.

It is obvious that to remove the piece from the fixture it was necessary to draw back the holding element at least 1¼ inches or more to provide the desired clearance between the casting and fixture.

It is also easy to imagine the time required to screw these back, as there were a number of such cases on the tool, providing the usual type of screws were used to hold the casting.

To overcome this trouble, in other words, to provide a quick-acting and positive holding device, the one illustrated was designed.

This is made with a threaded body C, which is made a snug fit in the wall of the fixture. On one side of the body is machined a slot D of sufficient length to take care of the distance between A and B.

At the inner end the slot is machined on an arc to an angle of 30 deg. with the vertical centre line. The shank of the pin E is made a good sliding fit in a hole of the body, and a pin F is driven in the shank, as shown.

To operate the device, the pin E is pushed up the slot by means of the knurled head until the inserted pin comes to the forward end of the slot.

The pin E is then turned by means of the knurled head and this screws the body forward and this motion also carries forward the pin against the wall of the casting, thus exerting the desired pressure.

To remove the casting it is only necessary to turn the pin in a left-hand manner when the small pin will pass into the horizontal portion of the slot and the large pin can then be drawn back by means of the knurled head.

With this device any variations in castings are taken care of with the threaded body, which can be either screwed in or out, as necessary, and further, a solid support is afforded with the large pin as it would have to shear off the small pin before the casting would move from its location.

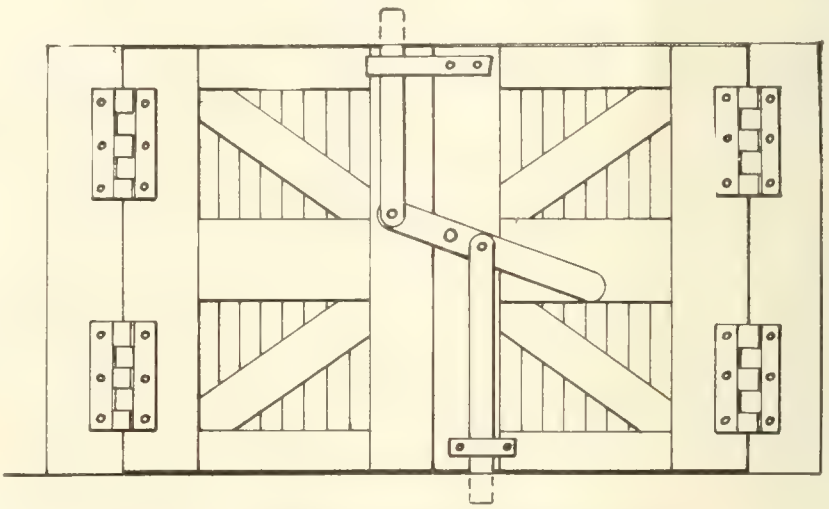
It might be added that straps were used to hold the casting on the fixture in the usual manner, the device described being designed only for a quick-acting locating medium.

It has now been in service for some time and is giving satisfactory service.

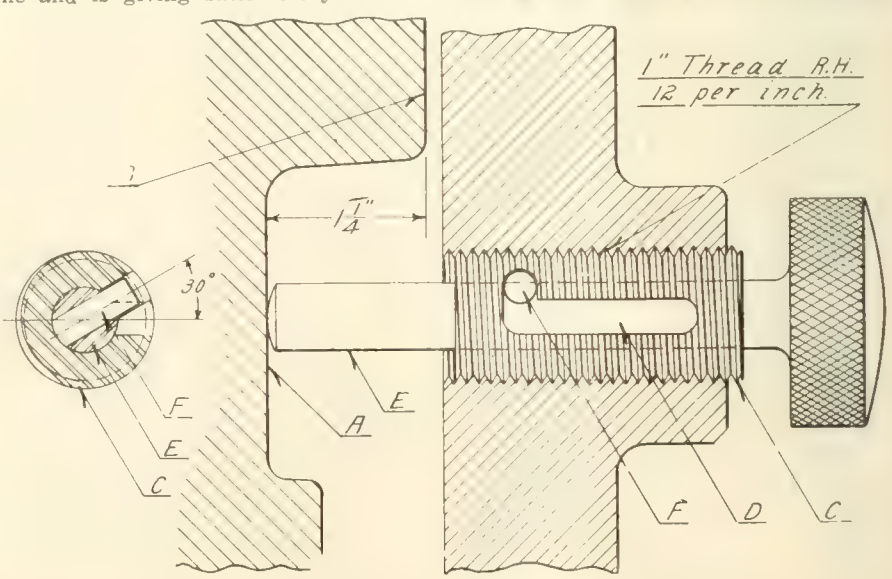
HANDY FASTENER FOR MACHINE-SHOP DOORS

By W. S. Standiford

With the usual style of latch for machine shop and other double doors that are exposed on one side the weather allows the doors to warp, which makes them difficult to fasten. To avoid this the fastener shown in the sketch was devised, which fills the bill perfectly and keeps them straight. The device consists of a 16 inch long, 2 inch wide, and ¼ inch thick steel lever working



SKETCH SHOWING FASTENER APPLIED.



SECTION SHOWING BAYNOT TYPE OF COCK

on a pivot on [illegible] door, a washer being placed between the door and the lever. At four inches to the right and left-hand sides of the pivot small holes are bored. Two U-shaped pieces are made out of flat [illegible] bars, they being of sufficient size so as to slide easily along the bar.

Two one-inch round bars are cut to such a length that they will project 1½ inches over the top of one door and the bottom of the other. One end of each bar is then welded to the centre of each U-shaped piece, a hole being bored at right angles to the side of the piece and through the legs. A rivet is inserted through the hole in the round bar and the legs of the U section; the rivet is to be of sufficient tightness so as to allow the bar to move freely up and down. Make a guide out of a piece of a rectangular iron bar; part of the latter should be twisted while hot at a right angle. A hole of sufficient size is bored in one end so as to let the bar slip over the top of the plunger, and screw holes being put through the opposite end. This bar holds the plunger in a vertical position; it also serves to guide the round rod into a hole bored in the casting above the door. To prevent wear on the holes in the casing and sill it is best to have a short flat bar of steel having a hole slightly larger than the round rod bored in its centre, and also having screw holes made near its ends. Make another piece of the same size, and screw them to the top casing and the bottom sill. A guide is also to be made for the bottom plunger; both the top and bottom plunger rods should be tapered slightly at their ends so that they will enter the holes bored in the casing and sill easily. When the handle of the lever is put in a horizontal position, the plunger rods are level with the top and bottom of the doors.

A downward push of the handle fastens both doors, the latter opening inward. A rabbet is nailed to the outside of one door and extending over the joint, making a stormproof joint. It is customary to have a small door equipped with a lock and key (door not shown in sketch) for entering the building made in the large door opposite the one carrying the lever. This is a convenience in the winter time as it keeps the warm air in the shop, the double doors only requiring to be opened for the industrial railway or other cars that enter. Some shops have the small door on the side or the other end of the shop, but it is much more convenient to have it in one of the double doors as it saves time in opening. In conclusion, this device will be found to be a most practical and convenient door fastener and to give good satisfaction.

THRUST COLLAR JIG

By G. BARRETT

The following jigs and fixtures were used to manufacture thrust collars for automobile clutches:

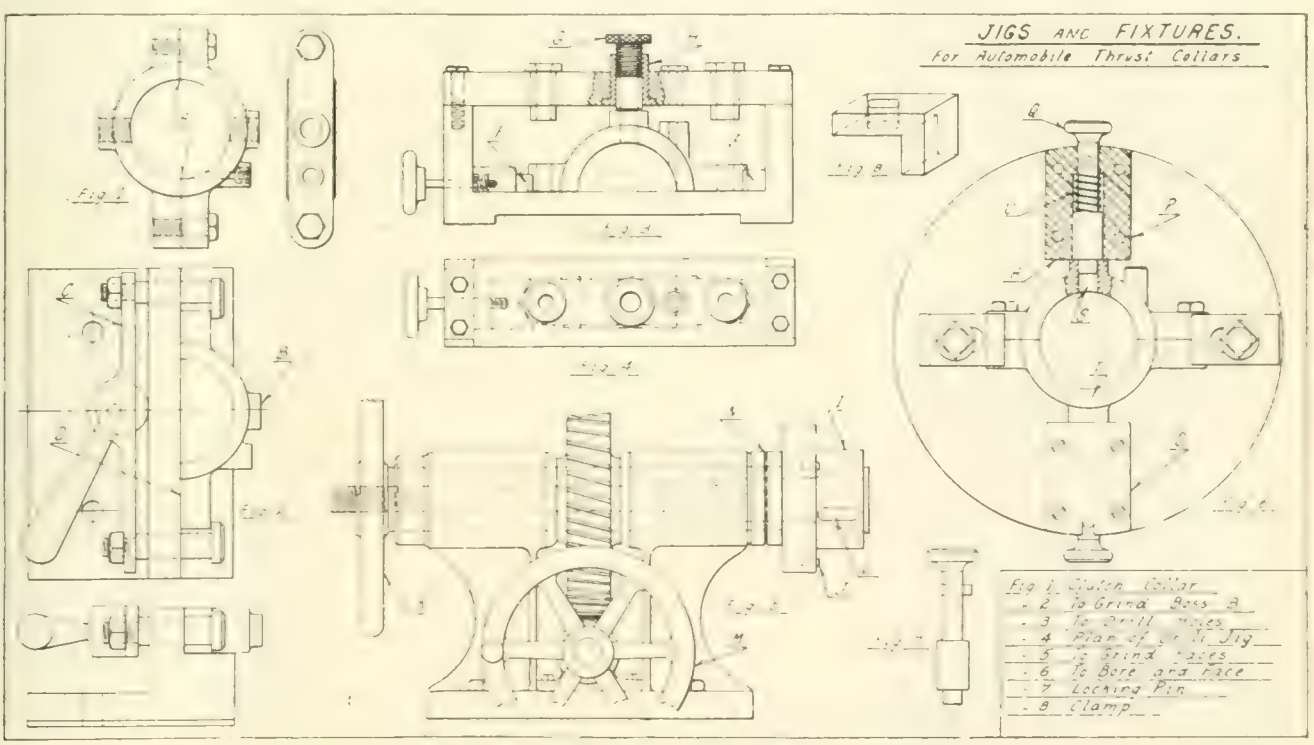
Drawing, Fig. 1, shows thrust collar assembled.

The first operation is to disc-grind one half of collar at parting A, Fig. 1, after which they are placed in fixture, Fig. 2, and ground on boss B. This fixture explains itself from plan view, Fig. 2, and end view, Fig. 3. The clamping device C, Fig. 2, is a good feature and holds the brass casting very firm during grinding; this operation was done previously by straddle milling after the collar had been assembled, but did not prove accurate enough. By the use of this fixture and disc-grinding the lugs and limit, from base D, Fig. 2, to B are kept within .004 and the production is 2,400 in 9 hrs.

The next operation is to drill bolt holes, oil hole, and yoke pin hole. These holes are drilled from jig, Fig. 3. The casting is located in jig vee blocks E and F and held by guide bush G, which is threaded and ground to fit pilot bush H. The other bushes are made a push fit in top plate of jig, so as to be replaced by ones smaller in sizes for drilling tapping hole in opposite half of casting. Fig. 4 shows plan view of drill jig and will give the reader a better idea of the vees for locating the casting and will note that E is stationary and F is made to slide in and out, so as to remove castings from the front of the operator, as there are 3 different sizes of holes to be drilled. We use Modern Magic drill sockets, which are a great time-saver where the multiple can't be used.

After drilling and tapping the castings are assembled and passed back to the disc grinder to be ground on one face; for this operation the fixture, Fig. 5, is used. The clutch collar to be ground is placed on the mandrel at I and held against three steel pins, J, and are held by tightening handwheel K, which expands the jaws L. The table of grinder is then brought forward till the casting is in contact with emery disc, then the spindle is caused to revolve in the fixture by a worm and wheel operated by handwheel M, the thrust from pressure of grinding being overcome by ball bearing collar N. This operation is also 150 per cent. faster than lathe work and more accurate.

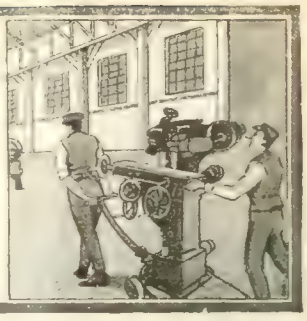
(Continued on page 561)



GENERAL DETAILS AND ASSEMBLY VIEW.



DEVELOPMENTS IN SHOP EQUIPMENT



SIBLEY DRILL PRESS

The Sibley Machine Company, of South Bend, Ind., have recently placed on the market a new sliding head drilling machine with positive geared feed, in which they have incorporated all of the proven features of their older models, with the addition of new and exclusive ones.

This machine is specially designed and built throughout, to meet the requirements of modern production methods—speeds and feeds are selective, and have an unusually wide range. The base is well ribbed and braced with tee slots for clamping work. Increased length of bearings on head and arm and substantial table support give added strength and accuracy. Head and spindle are balanced by a weight supported inside of column, with Diamond chain operating over large diameter sheaves.. Safety of the operator is assured through enclosing of gears. Belt guards can be furnished as special equipment.

One of the new and exclusive features is the fitting of all drive-shaft bearings with die-cast split bushings of a high quality anti-friction metal. These bushings are interchangeable and insure long life to the bearings and easy replacement. Drive pulleys and three step cones carry wide belts, while with the generous bevel and back gear ratios, abundant power is delivered to the spindle. Long range of the head and spindle on column permit the use of large jigs. Back gears are of the sliding type, fully enclosed, and operated by a single lever. Spindle is provided with ball thrust bearings.

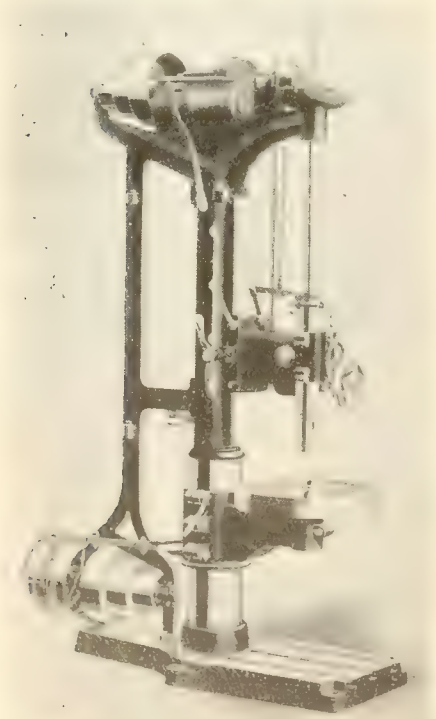
Another feature of this machine is the new geared feed, with four changes and a neutral position. Feed changes are obtained by moving a knob conveniently located in the centre of the hand wheel in connection with a sliding spline, four feeds being provided for each spindle speed. The initial drive of the feed shaft is from the top cone shaft through spur gears and two to one spirals, the latter bronze and steel respectively. This arrangement is very compact, the gears run in an oil bath and are completely enclosed. The steel worm which meshes with the extra large worm gear also runs in an oil pocket. The adjustable automatic stop of new design is quick and positive in action. Hand feed and quick return of spindle is through the medium of a three-lever spider at right of feed box. Hand wheel is of large diameter.

Special attention has been given to the oiling of the machine. All bearings are equipped with oil cups, grooves and channels, insuring proper distribution to the vital points. The loose pulley is self oiling, and will run several months without attention. All feed gears in the feed case are completely enclosed and running in oil.

Particular care is given to the finish of this tool, spindle sleeve and all shafts being ground. All machines are thoroughly tested before shipment.

Positive geared tapping attachment, geared or belted motor drive, round or square tables with tee slots and oil pocket, oil pump outfit complete, and quarter-turn countershaft can be furnished as special equipment.

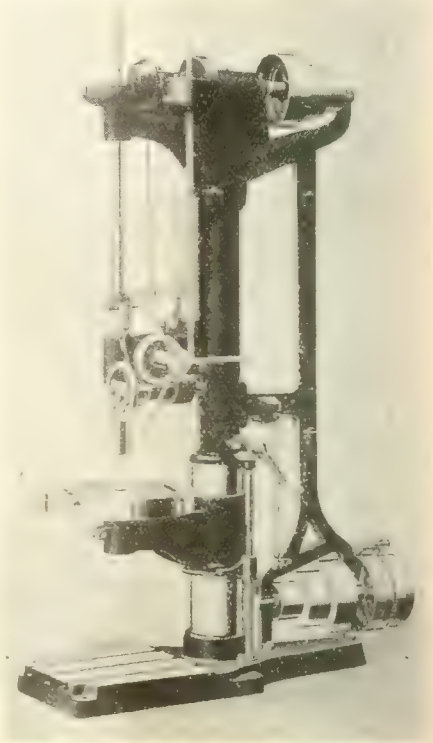
This machine is now being built with 24 in. swing.



SIBLEY DRILL PRESS.

WATTS SQUARE OR HEXAGON-HOLE DRILLING DEVICE

The Watts Bros. Tool Works, Turtle Creek, Penn., has placed on the market an arrangement for making square or angular holes. The equipment as shown consists essentially of three parts, a floating type chuck, a special drill and a guide plate.



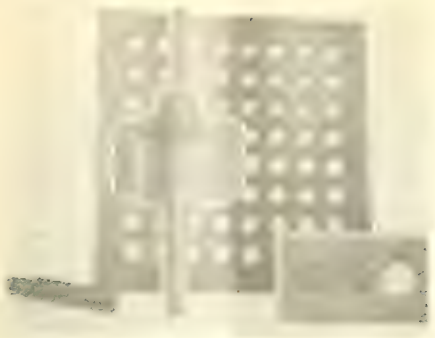
ANOTHER VIEW OF THIS DRILL PRESS.

The equipment is intended for use in any ordinary drilling machine or lathe and is recommended for work that cannot be broached, such as socket wrenches, collets, feed fingers for automatic screw machines, etc.

The tool or drill is an end cutter and works in a similar manner to an end mill. The guide plate is clamped to the work and acts as a jig, the floating chuck simply permitting the necessary lateral motion of the tool when cutting.

In operation a round hole is first drilled, leaving as little stock as possible for the special tool to remove as shown by the large plate in the illustration. The small plate shows the guide with the tool in the guide hole. The holes on each side are bolt holes to clamp the guide plate to the holder or jig.

The device is not recommended for deep holes and is limited to depths of two and a half to three times the diameter of the hole. It is furnished in four sizes with capacities ranging from ¼ to 1½ in. holes. The guide plates are ordinarily made in round shapes but can be furnished in special sizes and shapes for jigs. The chucks can be used on other work when not being used for angular holes.



THE WATTS SQUARE OR HEXAGON DRILLING DEVICE.

[illegible] of Hamilton, Ontario, [illegible] in Canada.

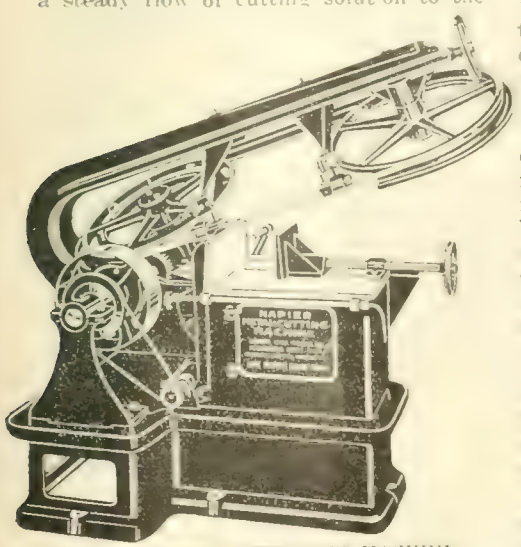
NAPIER BAND SAW, CUTTING-OFF MACHINE

The cut herewith illustrates the new type of Napier Metal Cutting Machine. It is claimed [illegible] band saw principle has many advantages over the ordinary reciprocating hack saw machine, inasmuch as the movement of the saw blade is continuous in one direction.

The plane of the cutting band saw is so inclined that the cutting portion is lower than the entire section, a condition that permits of cutting bars of any desired length. An interesting point in this machine design is the system of counterbalancing the horizontal cutting arm, a factor that provides for gravity feed, and permits of self adjustment to the varying densities and characteristics of the metal encountered. Owing to the inclined position of the saw blade it is necessary to provide some means of bringing the cutting portion of the blade to a vertical position. This is accomplished by two roller guides that can be adjusted on the cutting arm, and these guides may be so located that the cutting section of the blade can be kept at the [illegible] when small diameters are being cut. This feature likewise assures very accurate cutting of the bars.

The machine is equipped with a small rotary pump (belt driven) that supplies a steady flow of cutting solution to the work when desired, and the lubricant is delivered in such a way that the saw teeth are washed free of dust and cuttings, and the blade kept perfectly cool. Even cooling of the blade is also assisted by the relatively large wheels that carry the band saw, so that any heat generated by the blade passing through the work, is rapidly decimated into the larger body of cast iron. The wear on the teeth is evenly distributed throughout the entire blade, so that the possibility of drawing the temper is practically eliminated.

One of the most important advantages claimed for the Napier machine is the thinness of the kerf—less than .05 inch—and the resultant small waste of metal. In cutting high speed and alloy steels, this saving is very considerable. These saws have a capacity of 10 by 10 inches on any class of work. These can be supplied in either belt or motor driven types. All bearings are of substantial dimensions to insure long life under severe service.



NAPIER BAND SAW CUTTING OFF MACHINE

The saw blades are made in long ribbon strips and may be cut off and brazed to the desired length. The teeth are milled at such an angle as to give maximum cutting efficiency, with a strong broad base or root, that prevents the teeth from losing their set. The teeth and a slight portion below the root, are tempered exceedingly hard, and the remainder carefully toughened, leaving the blade with sufficient flexibility to prevent checking in its endless turning movement around the supporting wheels. The blades are made of high grade [illegible] steel and in widths from ¼ inch to 1 inch.

Lyman Tube and Supply Co., Montreal, are the sole Canadian distributors for these Napier machines.

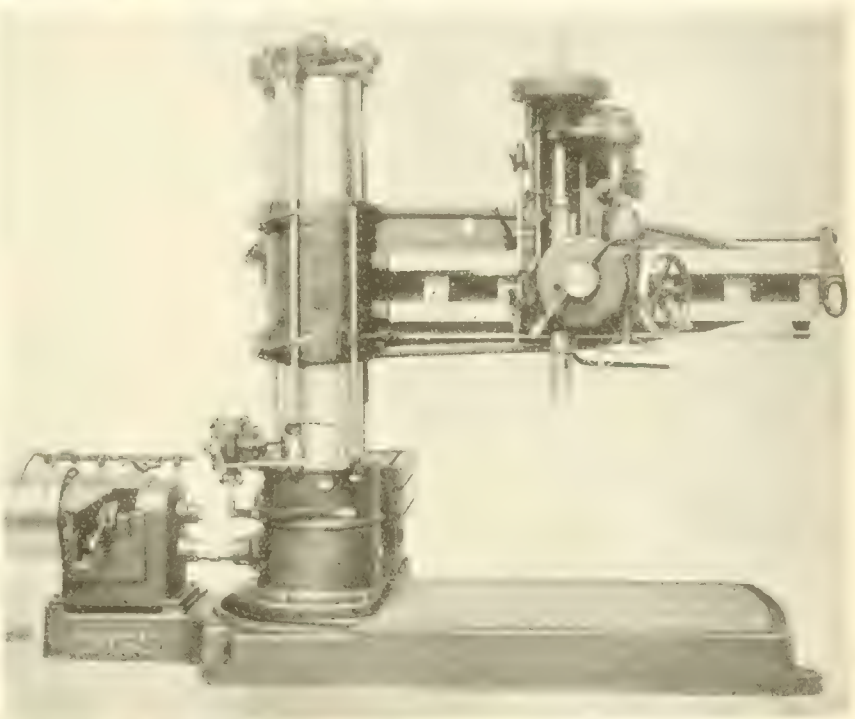
COMBINATION PNEUMATIC AND HAND-CLAMPING DEVICE

A new arrangement for clamping the column of their drills has been recently placed on the market by the Fosdick Machine Tool Co., of Cincinnati, Ohio.

This arrangement is quite different from the usual devices of this kind, in several respects. It is applicable to any of the Fosdick 4, 5 or 6-foot Heavy Duty Radials.

The most noticeable feature is the location of the cylinder, which not only brings the pressure directly to the point of clamping, but eliminates quite a number of the usual working parts.

It will operate equally as well on extremely high or extremely low pressure, and during tests operated very successfully on 45 lbs. pressure.



VIEW SHOWING THE PNEUMATIC CLAMPING DEVICE

Relief valves are provided for each end of the cylinder, and are regularly set for a pressure of 45 lbs., although 150 lbs. or more will show no shock or jar in clamping or unclamping.

This is accomplished by an air cushion at each end of the cylinder, formed by additional ports in the valve, to cause a compression at the proper termination of each stroke.

The valve (a six-ported flat disk valve) is operated by mechanical connection to a horizontal shifter bar running along the entire length of the radial arm. The advantage of this device is that it has no connection with, and does not interfere with, the moving of the spindle head.

In case of failure of the air, pet cocks at each end of the cylinder are opened, and the ordinary method of clamping by hand is used.

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No Apologies Needed

A MACHINE erector finished up a certain installation running into some thousands of dollars. He was in a hurry to get away to another bit of work, and at the end of the week announced that the machine was ready to operate on Monday morning when the plant started.

"Better stick around until Monday to see that it goes all right," remarked the superintendent. "Last time we had an outside man here we had to bring him back to get his machine started right."

"That machine will run," replied the expert, as he continued to pack his grip, "and there will not be any need to touch it."

"What makes you so certain?" queried the superintendent, "you haven't tested it yet?"

"So?" remarked the expert. "That machine was tested, piece by piece, in the inspection department long before it was ever erected. I know every operation in its make. I was almost going as far as to state that I know every man who attends to every operation. I know that our firm never allows anyone to take a chance. I am so certain that that machine will run on Monday morning without ever having seen it operate in your plant that I will come back at my own expense if you wire for me on account of trouble."

The superintendent was a little doubtful as he saw the expert leave on the Saturday train. Monday came, and the power was turned on the new machine. The superintendent had allotted a good mechanic to run it, thinking to give it a fair trial. He dropped around a couple of times in the morning and again toward five in the afternoon.

"Anything wrong with the new machine?"

"Great. Works exactly to dimension. Never saw anything better."

When the superintendent returned to his office there was a wire from a city some ninety miles off, from the expert who had set up the machine. It said just this: "Why don't you send for me?

"If you are the head of a concern making goods, if you are a foreman, if you are a mechanic, are you backing up the men who are on the road for you in this matter? Have your men got to be good apologists in order to get your lines in the shops? What more does a man who goes out want than to be able to say "That machine will run. It has been tested and inspected piece by piece before it was ever assembled. I know the men who built it, and I know what sort of work they can do. I can stake my entire reputation on its performance."

Accomplishment of that sort will do more to put goods on the market than all the catch-penny slogans that can be pasted and painted on your goods and in your advertising propaganda.

Never ask an outside man to apologize for lack of excellence in your product.

Not a Mechanical Problem?

WITH varying degrees of complacence the residents of the district affected would read in the papers a few days ago, that the price of milk was to be increased for Toronto, and of course that would mean the price of butter as well. The latter expected to get out of its present lowly rut at 65 and 70 cents and march right along until it camps at the 90-cent mark.

Milk is expected to go to 17 or 18 cents a quart. A dollar, it is expected, will soon buy only 11 or 12 pint tickets.

Perhaps you may ask what this has to do with matters in which we are primarily interested, such as mechanical, engineering and selling problems. Just this. Forcing up the price of things that the men in the shops and their families have to eat in order to live means keeping afire the feeling of unrest and discontent.

Every time the man in the shop sees where there has been a meeting of men engaged in a certain line of business, and following that meeting there comes a notice of an increase in the price of something he must buy for his family, that man in the shop is going to set to work to get sufficiently more from his employer to keep pace with the stride being set for him by the producers and dealers.

It is his failure to keep pace with the increasing costs that keeps him on edge.

Although fundamentally not a mechanical problem, the meeting together of men for the purpose of further bolstering up prices of milk and butter, is very much a problem of every mechanic in the region affected.

It is likewise and very directly a problem of every employer of labor.

Another two-cent jump in the price of milk may do damage so great as to be altogether out of keeping with the size of the increase.

AN evangelist who was conducting nightly services announced that on the following evening he would speak on the subject of "Liars." He advised his hearers to read in advance the seventeenth chapter of Mark. The next night he arose and said: "I am going to preach on 'Liars' to-night and I would like to know how many read the chapter I suggested." A hundred hands were upraised. "Now," he said, "you are the very persons I want to talk to—there isn't any seventeenth chapter of Mark."—Boston *Transcript*.

* * *

A CAPTAIN of a lake vessel who was floating around on a piece of wreckage states that he was refused help by a passing ship. A case like that should be sifted to the bitter end to find out all the facts. And if the facts bear out the claim there should be third degree treatment right straight off.

The Old Family Group

IT is not pleasin' unto me, in fact, it grieves me sore, to see some things a-passin' we loved in days of yore—folks seem to be all changed about in this here awful age, a-tearin' here and there, by gum, in one mad, giddy rage.

It causes me to shed a tear the way they've put the boots to them there photos that we called the old-time family groups.

I love to gaze upon them things, their faces and their gowns—their countenance set for the pose, all freed from grins and frowns. They set there lookin' back at me, that group took years ago, poor things not knowin' that them groups was out-of-date and slow.

Why, when they go out nowadays to get their likeness took, folks try to look like some front page from out a "movie" book. The women get a yard or two of fly-nets round their bones, by far too flimsy and too thin to venture from their homes. They gaze up at the rafters, 'cause the photo man says so; they're dressed in some partic'lar style with no place much to go. And when their friends grab off the prints they snicker and they grin; the things they say they constitute a high crime and a sin. But to their faces they cry out, "Oh, excellent! Oh, fine! Prunella, dear, your profile shows a snout that is divine!"

Likewise when Dad goes out to sit before the camera man, he has to have an egg shampoo, also a meal of bran—he looks as great men look each day, as though he'd like to feel just how 'twould be before the night to swing a million deal. Why, if Dad pulled that picture face when trudgin' 'bout the house, we'd swear he was recoverin' slow from some hard cider souse.

Of course, we've got to be in style like all the other folks; it aint no use in laggin' like a lot of has-been blokes. But all the same, them family groups look powerful good to me, when Dad was young and handsome and Maw was twenty-three. I like to look at them, I do, just settin' there, by heck, without no care or worries a-campin' on their neck. No cheese cloth wrapped about Maw's chest, nor yet upon Dad's jaw is fixed an attitude to state he's gone and bust the law.

Ah, yes, I know it's out-of-date to have a family group, but for them photos nowadays I don't care one durned whoop. Lead back the good old family group with pleasant face and sweet, with palm trees rustlin' in the rear and foostools 'round their feet.—ARK.

It is claimed that the best method of utilizing the peat resources of Canada efficiently would be by gasifying it in gas producers, as in this system the valuable by-products contained in the fuel could be recovered. The combined nitrogen of the peat can be economically secured in the form of ammonium sulphate, and the valuable fertilizer, with the peat ash containing potash and phosphoric acid, could be restored to the land from which the peat has been taken. Peat tar is a source of refined pitch and tar, candle wax, lubricating and burning oils, and powerful disinfectants greatly exceeding carbolic acid in germicidal strength. The valuable by-products of methyl, alcohol, acetone, pyridine bases and crude acetic acid, can be recovered from the aqueous distillate from the producer.

* * * *

For a long time the waste steam from steam-engines has been turned to good account, but there have been difficulties in the way of using the exhaust gases from a gas-engine as they readily attack the metal of the conduits. However, the difficulty is being overcome, for a New Jersey candy factory has an installation in connection with a sixty horsepower engine which is used to heat the factory. The gases pass through an economizer made of cast-iron, with the passages to the different sections staggered so that all parts are heated for the whole length. Water circulates in jackets surrounding the gas passages.

Where Industries Will Go

ACCORDING to reports, a number of the industrial centres of Canada, particularly in Ontario, are holding out very plausible looking inducements to firms looking for locations. In some cases it does look as though there were a sort of a competition on, with the competitors tossing up free sites, tax exemptions, free water, cheap power and what not to land the bacon.

The city that sets out seriously to become an industrial centre has to do something deeper than any of these flash-in-the-pan things. Industries do not gallop away for trinkets if they are going to grow well.

The city that has a large part of the battle fought is the city that has conditions that are favorable to the development of a good labor market. And what's that? Simply that it shall be a good, wholesome place for a man to bring up his family; a place where he can own property without having to hand out a slice to every speculator and manipulator; a city where it will pay him to settle with a view of becoming a fixture; a city where the houses have a little land to the sides and rear—in short, a city which, when he has been away for a time, looks powerful good to him on his return.

Don't make any mistake, the firms that are looking for sites for factories in Canada, if they represent worth-while parent concerns, can take these conditions in, and they put them down very close to the top of the list.

A municipality is only fooling with itself and joking with its people when it imagines it can worm itself into being an industrial centre on the strength of a free site and exemption from taxation.

An industry is not like a convention, which goes where it is invited. The worth-while industry is going to locate where it has a chance to grow, and it cannot grow without a well-housed, contented working force.

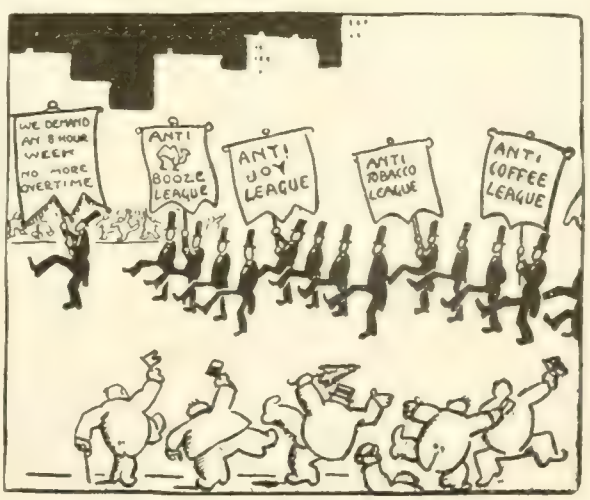
Can your city line up to these considerations? If not, your first step is in getting your house cleaned and in shape before going out with a beckoning forefinger to worth-while concerns that are seeking locations in this country.

VICTORY Loan workers were dined in a Toronto hotel. The little chap who scrubs along and pays for a bond is the chap worth dining.

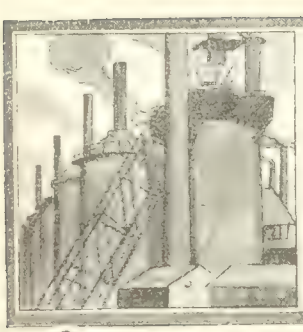
* * *

MILK goes up on December 1, according to reports. When we stop to think how we used to try and make calves drink the stuff out of a tin bucket we weep, gentlemen—we weep.

THE doctrine of decreased production and a bob-tailed work day is not going to put Canada where she belongs in the industrial world.



IF THE REFORM LEAGUES WOULD ONLY GO ON STRIKE!
New York "World."



MARKET DEVELOPMENTS



Securing Material is the Greatest Problem Now

Shipments of Steel Coming Through at the Rate of About 65 Per Cent. of Normal Times, While the Demand is Very Keen—Canadian Firms in the New York Tool Market

SECURING of supplies is becoming more and more a problem with the industrial world in Canada. Many firms are realizing now that dealers and salesmen of steel and machinery were quite right some months ago when they warned them that there was a serious shortage ahead. Firms that went into the market then and got their business booked are getting deliveries now. Firms that did not have simply to content themselves with getting what they can, and with knowing that any business they may put in now has a great procession ahead of it, making deliveries very uncertain. The premium market is coming to be more and more openly recognized in the steel business, and many mills that have not been known as being in the premium class before are now selling at a price based upon their ability to deliver. There is also a tendency, although hard to locate, that tries to hold back a certain tonnage in prospect of a very active and high market later on.

The shortage of steel, coupled with restriction on the use of coal, has a tendency to make buyers a little more conservative. But for all that there is a nice volume of business moving in the machine tool market, and the business is well scattered, no one industry doing all the buying. Several Canadian firms have fairly large lists in the New York machine tool market this week.

Canadian machinery dealers are recognizing more and more that the day of specialization has arrived and they are preparing to meet this new situation. One firm this week has sent its best man to study production methods in other countries, and he will devote his whole time to pointing out, on his return, where operations that are now done on a general machine should be turned over to a machine built especially for the purpose. It is really applying the single-purpose machine idea, which secured such results during the war.

Copper prices in the scrap market sagged during the week. It is hard to sell copper owing to the rate of U.S. discount, hence there is an accumulation.

MONTREAL MARKET LOOKS FOR FIRM OR HIGHER PRICES IN STEEL

Special to CANADIAN MACHINERY.

MONTREAL, Que., Dec. 4.—There is little doubt in the minds of the local steel men that the industry is gradually returning to a position where higher prices will be the order of the day, and these may not be far short of those prevailing throughout the later years of the war period. It is probably true that the demands were greater a couple of years ago, but production was in accordance to existing requirements. Now we are confronted with abnormal post-war demands for steel, and the attitude of labor prevents the full utilization of production facilities for the relief of a situation that is daily becoming more serious in the resultant effect upon this country in particular and the world in general. While the unreasonable struggle continues, the people at large must continue to wait and suffer patiently. With the near approach of winter the difficulties of transportation will be added to the scarcity of fuel and many [illegible] will likely be faced with a shutdown or curtailed production. The closing of navigation will increase the difficulties of obtaining coal from the Maritimes, so that extreme conservation will require to be exercised to avoid a serious shortage of coal this winter.

Steel Lines Advancing

In view of the conditions that do exist, and which are being constantly aggravated by the coal strike and the general disturbed state of transportation, a factor that will be further pronounced as winter approaches, the possibilities of seeing the prices of steel commodities back to a war level, is becoming more and more certain. The demands for every class of domestic steel is so pressing at the present time that any long duration of under-production would create a serious situation, and one that has little chance of alleviation as long as fighting differences exist between the workers and the operators. It was stated by one dealer here that from the coal mines of one large U. S. steel mill, not a ton of coal had been mined in nearly three weeks. Their stock on hand will only last a short time and when this available supply is consumed, suspension of mill operations will necessarily have to follow. It is estimated that current production of American mills is 50 per cent. below normal and trade requirements are far above the average mill capacity of the country. Mill refusals to accept bookings are common procedure, and where producers are accepting business, no assurance is given as to when the material will be delivered.

Local warehouse stocks are gradually being depleted of the lines in general demand, and the uncertainty of renewing these stocks is becoming a matter of some concern, and this condition can only have one logical result a stronger market at advanced prices.

Canadian mills are benefiting by the falling off in American production, particularly in those lines that are within the range of the mills. Dealers here are anticipating a gradual return to higher market levels, and some would not be surprised to see "war" quotations this winter. Local prices on chequered floor

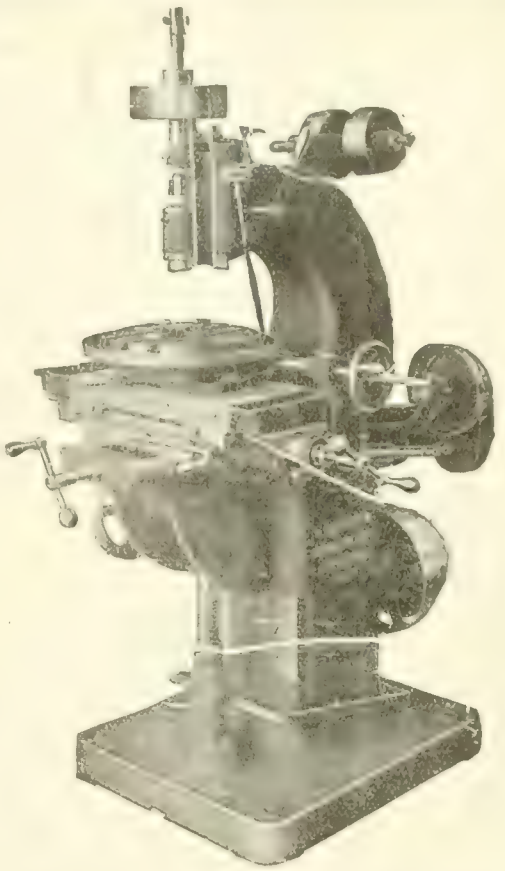
BECKER

Belt Driven Millers

The Machine that Gives the Smooth Finish

Stringent shortage of labor during the war put a premium on machinery of superior productive ability. Never was the capacity and value of Becker Millers better emphasized than during that period. And Becker Millers will always continue to demonstrate their ability to return maximum production for minimum expenditure of manual effort.

Send us blue prints of your work and other data and we will submit estimates on Becker production. Adopt this "safety-first" course; it may mean added profits to you.



The A. R. Williams Machinery Co.
LIMITED, TORONTO

GENUINE EMERY

Sizes 180, 160, 140, 120, 110, 100, 90, 80, 70, 60, 54, 46, 40, 36, 30, 24, 20, 18, 16, 14, 12, 10, 9, 8, hole.

EMERY FLOUR AND WASHED FLOUR

EMERY GLASS FLINT GARNET CORUNDUM CARBORUNDUM	PAPER AND CLOTH	IN SHEETS, ROLLS, DISCS, BANDS, STRIPS and TAPES, &c.

John Oakey & Sons
LIMITED
WELLINGTON MILLS
LONDON, S. E. 1., ENGLAND

MORROW SCREWS MORROW

JOBBERS

of the highest grade goods carry the best set and cap screws and "MORROW" Drills because they know this make will give their customers better service.

CARRY

the Morrow Screws, Nuts and Drills, for their customers even although they don't make as much profit on them. **It is in their customers' interest to do so—better value.**

MORROWS

A strictly Canadian industry. Canadian workmen and Canadian capital.

WORKS AT INGERSOLL, CANADA

Ingersoll Files equal to English Files. Buy them.

DRILLS FILES

MORROW NUTS MORROW

plates have advanced about one cent per lb., the price quoted being 7½ cents for the 3-16 inch, and 7 cents for the ¼ inch size. Plates have been advanced $7 to $10 per ton, the new quotation being $5.00 per hundred for ½ inch and up, and $5.25 for 3-16 inch. Quotations on billets have been changed to conform to the prices f.o.b. Pittsburgh, and these advances range from $4 to $7.50 per ton. Forging billets are now quoted at $56 per ton. Sheets is one of the products that has been hit by labor troubles, and supplies of this commodity are considerably below the trade demands. No. 10 gauge, black sheets, are now quoted at 6 cents per lb. Boiler tubes are still hard to secure and prices are firmly held. The price on 1½ inch seamless and lapweld, and on 1¾ inch lapweld, has been advanced 50 cents per hundred feet.

No Change in Metal Situation

Scarcity of finished materials still dominates the metal market and uncertain deliveries of these lines is the chief factor of the present disturbed state of affairs. There is a fair demand for ingot metals, but trade requirements for sheets are much larger than production can take care of, and output may be still further affected by the increased shortage of coal for operation of smelters and refineries. Dealers are holding firm to the nominal prices now quoted, but anticipate a stronger market.

Tool Movement Quite Good

The question of shipment is still a factor in tool business, and sales would probably be larger if users could be assured of a definite date for delivery. This, however, the manufacturers or dealers are unable to do, and the uncertainty in this connection will be further evident while labor and transportation troubles occupy the greater attention of industrial executives. Reports of local dealers differ in the extent of business transacted, but the general impression is one of good business, with sales quite fairly divided between new and used machinery. Existing conditions are assisting the Canadian manufacturer of tools, and dealers are doing what they can to induce purchasers to patronize Canadian makers of tools they are in need of. The conditions are such that prices may show advances in the near future.

Non-ferrous Scraps Weaker

The situation has again developed a dull tendency and trading has taken on a quiet trend. The disturbed conditions across the line has been reflected in this district and dealers are not keen to predict what the early conditions will be. The coal strike has not aided the re-establishment of normal industrial activity and curtailment of general enterprise is second only to the inability to meet the country's requirements for steel. The demand for scrap is proportionate to the steel production and with many American mills closed or contemplating closing, the consumption of old material in larger quantities must await the return of the coal and steel workers to their usual employment. The local movement of scrap continues in fair volume in the district, but nonferrous scraps have weakened as a result of the lighter demand in relation to available supply. Coppers are quoted at from 14 cents for light to 17 cents for heavy and crucible, a decline of one cent per lb. Brass scrap has also developed a weakness and prices are marked down from 1 to 2 cents per lb. Iron and steel scraps are comparatively firm, but the undertone is unsteady. Wrought iron, on a decline of $1.00, is quoted at $9 per ton. Machine shop turnings at $7 shows a drop of 50 cents per ton.

POINTS IN WEEK'S MARKETING NOTES

The scrap market shows the following lines as being stronger and higher in price: Heavy melting steel, steel rails, malleable iron. Coppers, on the other hand, are not so strong, and prices are off compared to recent offerings.

—

An acute shortage in this district exists in bar products and semi-finished steel. Users are pressing the mills pretty hard for delivery, but the response is still short. About 65 per cent. of a normal volume is coming across now.

—

Several large enquiries are in the New York machine tool market now, among them being a couple from Canada.

—

A nice order for carbon drills was placed by the National Railways during the week.

—

A couple of shipments of machine tools came through this week in advance of promises, a thing rather unusual in recent years.

—

Dealers report a very satisfactory volume of business moving. The fact that prices remain high does not seem to interfere with sales at all. Delivery is still the chief consideration.

—

Canadians are quite interested in the sales of machine tools and equipment being held by the U.S. army department, clearing out the war shops. Some who have attended these report that prices run high, in several cases going, under bidding, past the price that would be asked for the machine when new.

DELIVERIES NOW ABOUT 65 PER CENT.

But Not Fast Enough to Keep Up With the Requirements of the Trade

TORONTO.—For the first time in many weeks some of the machine tool dealers in this district are willing to admit that there is some signs of improvement in the deliveries that are being made to them by their principals.

The steel strike may be broken, but it is not showing much yet in the deliveries that are made. It sizes up the situation fairly accurately to state that deliveries are about 65 per cent. of what should be coming through in normal times.

The Machinery Market

Prices are firm in the small tool section, with a good-sized volume of business moving. Toronto dealers received a nice piece of business from the National Railways during the week for carbon drills. Buying at present is becoming more general, although some of the firms that may be affected by the coal shortage are not keen to put in any very great stocks. Plants that are working on automobile parts are increasing their operations almost every day, adding a few more machines to their capacity, and this all means that there is a greater day-to-day call for supplies.

There have been a couple of agreeable surprises during the last few days regarding deliveries of machine tools. Some firms seem to make a specialty of not promising anything very close at hand, and then trying to improve on the delivery schedule that has been tentatively suggested. It is much preferable to the rash promise of a good delivery, which can never be carried out.

According to the New York letter to CANADIAN MACHINERY, appearing on the next page, a couple of Canadian firms are in the market for some rather extensive equipment.

About 65 Per Cent. Now

According to the office of one of the large American corporations in Toronto, the shipments of material from the strike zone in United States entering Canada, are about 65 per cent. of what should come across in normal times. Asked if that was any improvement over the past weeks, the dealer admitted that it was not, and stated his belief that it would be some time before a real improvement would be shown. There are troubles that have not come to the surface in the strike, and apparently a labor shortage is now going to crowd in on the space lately occupied by the strike in the centre of the stage.

Booking is still going on, but many of the companies here are not keen to write more business until the prospects are better for getting outstanding business converted at the mills. There are many manufacturers who are anxious to know when their material is coming in.

GEOMETRIC



"YOU CAN'T BEAT 'EM"

SELF-OPENING DIE HEADS

It is not the manufacturers of Geometric Self-Opening Die Heads who make this statement, but the users of the tools.

This is the reason that besides being the originators, we are known as the

LARGEST AND BEST KNOWN MANUFACTURERS OF AUTOMATIC THREADING TOOLS

The big question is: Have you applied Geometric Screw Thread Cutting Tools to your threading work?

THE GEOMETRIC TOOL COMPANY

NEW HAVEN CONNECTICUT

Canadian Agents: Williams & Wilson, Ltd., Montreal: The A. R. Williams Machinery Co., Ltd., Toronto, Winnipeg and St. John, N.B. Canadian Fairbanks-Morse Co., Ltd., Manitoba, Saskatchewan, Alberta.

There is a marked tendency now, and it will likely increase in the future, to press the companies for material that has been booked now for some months. Bar products and semi-finished goods are away off for the present. There is quite an activity in the premium business just now, in fact the price of a good many sales is really based on the ability to deliver the material within a specified time. It often pays a manufacturer to put up a premium for quick shipment, rather than see his workshop shut down and his organization scattered. In some cases mills are asked a $7 bonus on plate. The Steel Corporation, as far as this paper can learn, has not departed from its schedule that has been in effect for some months. However, the man who has the goods to deliver is apt to get a better hearing than the seller who puts a three to six months' space between the order and the delivery. There is a great deal of premium business being carried on both here and in United States.

It does look as though there were going to be a lot of business piled up against the spring operations of the mills. There has been a lot of business sent in from this district, and it will be months yet before the last of it gets a ride across the border.

The Scrap Metal Trade

Coppers were marked down in the list of what the dealers would pay for old material this week. The chances seem to be that the prices may go still lower. The reason for it seems to be in the much-talked-of rate of exchange, and it comes about in this way. It is becoming a hard matter for United States to sell copper abroad on account of the way in which the money of other nations is discounted at Washington. For instance, taking the present price of No. 1 electrolytic, at 19c, it would cost England about 25c, it would cost France 30½c, while the Germans would have to pay about $2.50. It all means that these people are going to stay out of the United States market for copper supplies. There has been some reduction in output, but not enough to balance the way in which material is piling up, owing, as stated above, to the rate of exchange. The coal strike and the steel strike, now practically over, are still holding back trade.

The ferrous metals are showing up much more favorably, and they are very much in demand. Heavy melting steel went up $2.50 per ton, while advances were noted as follows in other lines:

Steel rails up $2.50 to $16; malleable iron up $3 to $20.

"As things stand at present," said one dealer to-day, "it looks as though malleable were about the cheapest thing on the market. Malleable and cast scrap are very much the same, both of them being governed by the price of pig iron. Although there has been a recent jump of about $4 per ton in pig iron, malleable [illegible] is selling for $20, and No. 1 scrap at $25." Many foundrymen, though, are not disposed toward using malleable scrap. They claim they cannot get it to work with any other material, as they can do with stove plate. Malleable is hard when first cast, then heat-treated, but when it comes back to be recast it returns to its hard state. It is used mostly in the tail-ends of heats or for casting some job where the analysis of the material is not of much importance.

NOTHING LIKE A CAPACITY OUTPUT OF STEEL FOR MANY MONTHS TO COME

Special to CANADIAN MACHINERY.

PITTSBURGH, Dec. 4.—The iron and steel industry is in the midst of troubles, not being entirely out of its own strike while the coal strike threatens to curtail its operations. There has been scarcely any coal delivered to the steel mills since the coal strike started Nov. 1, most of the coal consigned to mills being held up by the fuel distributing authorities. Mills have been able to get along fairly well with their stocks, but these are now largely depleted. On top of this situation, making it uncertain whether there will be enough coal to enable all mills to continue to operate, comes the danger that the production of coke will be restricted in order to release coal for the most urgent uses. Curtailment in coke production would decrease the make of pig iron, of course, while in addition it would interfere with operation of plants that depend upon blast furnace gas for their power.

Strong hopes are entertained that the coal strike will be broken by the strenuous measures adopted by the Government upon refusal of the miners' officials to accept the 14 per cent. wage advance proposed by Dr. Harry A. Garfield, Fuel Administrator. The Pittsburgh Coal Co., by far the largest coal interest in Western Pennsylvania, promptly announced that it would co-operate with the Government and endeavor to operate its mines. If the strike is ended in this way it will be a victory for the Government and the people, not for either the operators or the miners. The operators had expected to pass to the public any additional cost they might incur through a wage increase, perhaps with an addition on the side, whereas Dr. Garfield prescribes that the 14 per cent. advance is to be absorbed by the operators, with no increase in coal prices.

The Iron and Steel Strike

The iron and steel strike, described in last report as "crumbling," has gone entirely to pieces in Mahoning valley. Men have stampeded back to work, and at the plant that was slowest in resuming during the past few weeks applicants for jobs in some departments are being turned away, as the departments are already fully manned. The entire productive capacity of the valley is not yet in operation, but work is being resumed as rapidly as possible.

In the Wheeling district the strike still hangs on, but there is likely to be a stampede there within a week or two, since the strikers have at last learned that newspaper reports are correct to the effect that various other districts have been working.

There is no disorder anywhere, and except perhaps for the Wheeling district there is no intimidation. Thus, in the main, the men remaining out of employment are actual strikers, whereas early in the strike many men were idle because of intimidation. Taking the industry as a whole the men idle now amount to between 10 and 15 per cent., as many as the maximum number idle when the strike was at its height, in the first week. How many men are in employment is another matter, for there have been gains by some new men coming into the industry and losses by some men drifting away, a few thousand having gone back to the lands of their birth. Before the strike the industry was not fully manned.

The important thing now is not how much of the strike is left, but how well the works can operate, and that depends as much upon morale and efficiency as upon the actual number of workers. The morale, of course, is low at many works, the men knowing that as an aid to breaking the strike the employers were glad to have them in employment on any terms, even if they did not do much work. As to efficiency, there are some new men who must be trained from nothing, and there are many men who have shifted employment and must be trained in their new jobs. Even that is not all, as when the strike is recognized as entirely over many of these men may drift back to their old jobs and thus cause fresh confusion.

Production Prospects

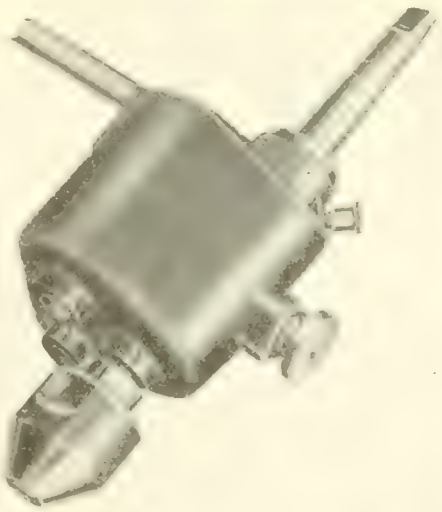
Altogether the prospects are clear that there will be nothing like capacity production for months to come, if at any time in the discernible future. Last January production of steel was at about 90 per cent. of capacity, figuring capacity on a conservatively low basis. The subsequent slump carried the rate down to about 50 per cent. the middle of May, and with continued recovery thereafter the rate just before the strike was about 85 per cent. For a few days the strike cut this in half, making a rate a trifle under 45 per cent. Now the rate is about four-fifths of that just before the strike, a trifle under 70 per cent., and the 85 per cent. rate may not be reached before next March.

In our report for the issue of Oct. 30 it was estimated that even if the strike should recede rapidly thereafter it would, all told, cause a loss in production of more than 2,500,000 gross tons of fin-

Aikenhead's

Wahlstrom Attachment

offers you the advantage of hand tapping plus drill press speed



The oscillating movement mechanically imitates hand-tapping, though 10 times faster, and reduces tap breakage to the very minimum.

AND THE WAHLSTROM ATTACHMENT IS ACCURATE. It taps holes as squarely as they could be drilled. Takes taps of all sizes up to ½ inch. **Sent on trial. Money refunded if you are not satisfied.** Write for bulletin.

Attached to any Drill Press will quickly Pay its Cost

Powerful Durable Trouble-proof

AIKENHEAD HARDWARE LIMITED

17, 19, 21 Temperance Street - - Toronto, Canada



Glue has the Greatest Sticking Strength when maintained at a temperature of 145 to 150 degrees Fahr.

It's easy to maintain this heat with "International" Electric Glue Heaters. They operate on dry heat, utilizing every bit of heat generated because conserving it on the fireless cooker principle. There is no evaporation of water or glue—therefore no waste. There are no burn-outs from evaporation of the bath because no water is used in these heaters. More of the glue is wasted because the electric dry heat principle prevents the formation of skin, scum or dirt on the glue.

Aikenhead's Electric Glue Heaters

For Woodworking and Pattern Shops

Cost of operation is but a trifle. Less current than an electric flat iron consumes is ample to operate 13 one-quart Electric Glue Heaters.

May we send our latest Bulletin?

AIKENHEAD HARDWARE LIMITED

17 TEMPERANCE STREET, TORONTO

If interested tear out this page and place with letters to be answered.

ished rolled steel, since after the strike the full pre-strike rate of production, which was about 2,500,000 tons a month, would not immediately be restored. A fair estimate to-day is a loss of 3,000,000 tons, this including allowances for deficiency in production in January and February, and no one can be certain that production will be going along smoothly even next March.

In these circumstances it is not surprising that steel consumers are seeking eagerly to cover their requirements for the fore part of next year, and that the manufacturers who do not as a matter of policy adhere to March 21 prices are asking advances for such material as they have to offer. The Steel Corporation pursues rigidly its price maintenance policy, but cannot in all cases supply even its regular customers fully. The independent tin plate mills are practically a unit in going along with the Steel Corporation in maintaining the regular $7.00 price, but less than half the independent sheet manufacturers are showing the same spirit as to sheet prices.

Pig Iron

The rise in pig iron continues. While some furnace interests a few weeks ago were professing themselves as anxious to see the market held on an even keel, they did not commit themselves by selling ahead at old prices and the forces in favor of advancing prices have had full sway. The Philadelphia market has advanced again, being now $37.60 delivered Philadelphia for No. 2X, while Buffalo and Cleveland have also advanced. In the Pittsburgh valley market a wide range of prices has obtained, according to tonnage and delivery. A small lot of malleable has sold at $35.25, valley and foundry has brought $35, valley for December. The top price on Bessemer has been $36 valley done on 100 tons for December, while a valley furnace sold Bessemer at $32 and then at $33, a detached Western Pennsylvania interest afterwards securing $34, delivery December to March inclusive, equal to $35.10, delivered Pittsburgh. Outside of fancy prices paid for small prompt lots the valley market is quotable at about $32 for basic, $33 to $34 for Bessemer, and $33 to $35 for foundry. The furnaces have been talking higher costs, and also claiming that they have made no money of late, even during the latter part of the war..

According to present appearances, Lake Superior iron ore will not be higher for the new season, but Connellsville coke will be much higher. The average cost in the past few months has been $4.25 per net ton at ovens, but the average is likely to be $6.00 and higher for the first half of next year. For a particularly good brand of coke some contracts have just been made at a ratio of 5 to 1 on basic pig iron, valley, which at the present $32 market would mean $6.40 for the coke.

U.S. SCRAP METAL

While there are many instances of advances in scrap material, in some districts the coal strike has knocked the bottom out of the market. Following are reports from United States districts:

CHICAGO.—While there is decreased buying by some interest due to the coal situation, others are keeping up their buying. This is particularly the case with rerolling mills, which although closed down, are still buying all the rails they can obtain. Cast scrap is active, and prices higher.

NEW YORK.—Most grades have shown an advance in price, those remaining stationary being heavy cast and machinery cast. Heavy melting is standing at $18 f.o.b. New York. Dealers seem to be holding back for further advances.

PHILADELPHIA.—There has been a general advance in scrap prices, and dealers are holding for still more advances. A lot of Eastern steel was sold at $24 delivered, Pittsburgh. Heavy melting is quoted at $21 to $22 delivered, but probably would be hard to get at this price.

PITTSBURGH.—Advances in this district are pretty sharp, with a good demand. A large lot of heavy melting steel is reported to have changed hands at $25.75 delivered at Massillon, O. Heavy machinery scrap has brought $29 delivered.

CLEVELAND.—A sale of heavy melting steel of 10,000 to 15,000 tons at $23 delivered is reported. There is a good demand for most grades, and the market is firmer. Dealers look forward to better prices for 1920. Malleable is around $26.

CINCINNATI.—Coal strike and car shortage are having a bad effect on the scrap market, but there have been advances in some grades. No 1 machine cast and cast boring have advanced approximately $1 per ton, and heavy melting is keeping its level.

ST. LOUIS.—The possibility of being closed down due to the threatened coal strike has caused many consumers to stop their buying, resulting in a bad jar to the market. A large offering of various grades at lower prices found no buyers. Railroad offerings amount to only 875 tons and little material is coming in from the country.

BUFFALO.—There is a demand for heavy melting in excess of the available supply, and the price is going up. $22.-50 to $23 delivered is about the lowest quotation. Other grades are also in demand, with an upward trend.

BOSTON.—The scarcity of pig iron has caused consumers to look for more scrap, and this in turn is short. $30 for No. 1 machinery, the highest price since the armistice, reflects the condition. Availability of cars here has brought business from districts where the car shortage is acute.

CANADIAN FIRMS HAVE SEVERAL INQUIRIES IN THE MACHINERY MARKET

Special to CANADIAN MACHINERY.

NEW York, Dec. 4.—Canadian companies are inquiring for machine tools in New York. One such inquiry is from the Canadian Ingersoll-Rand Co., Ltd., Sherbrooke, Quebec, and asks for quotations on one 10 x 20 ft. planer, one 16 x 24 ft. vertical extension boring mill, one 7 ft. radial drill, and one floor-type boring mill with 6 in. spindle. The Fraser, Brace Shipyards, Ltd., 83 Craig Street West, Montreal, Quebec, is inquiring for the following equipment: One oil-heated angle iron furnace, one plate bending roll, two vertical punching machines, six plate punching tables, two single-headed shears, one horizontal punching machine, three radial countersinking machines, one angle iron cutting machine and an emery wheel.

The American Locomotive Co. will buy from its New York office a considerable quantity of new equipment for its Montreal works, where foreign orders for locomotives will be executed.

Business in machine tools is booming in the East. Not since the war has there been such a large volume of buying. The automotive industries are the principal purchasers. The New Departure Mfg. Co., Bristol, Conn., a subsidiary of the General Motors Corporation, has placed orders for 400 to 500 tools, totalling its value close to $1,000,000. The company's output of ball bearings will be greatly increased. The Willys Corporation, Elizabeth, N.J., which will put a new light six cylinder automobile on the market, has bought about $500,000 worth of tools, mostly special machines. The H. H. Franklin Mfg. Co., Syracuse, N.Y., is in the market for equipment for a plant addition.

Among other companies which are buying or inquiring for tools are the General Electric Co., Western Electric Co., Worthington Pump & Machinery Corporation, C. H. Johannson, Inc., Poughkeepsie, N.Y.; American Car & Foundry Co., Liberty Starters Co., Poughkeepsie, N.Y.; and the Eastern shipyards are inquiring and buying a few new tools.

The Standard Oil Co. of New Jersey has bought about $150,000 worth of tools and plate-working machines for shipment to Roumania. This is the largest export order placed in some time.

Deliveries on machine tools are getting further off. One Eastern company is sold up until the end of 1920 on a line of automatic machines. An Eastern lathe builder received orders last week for upwards of 100 lathes. Many tool builders have orders on their books for three to six months. Prices are recording no important changes, and sellers predict that there will be no further advances unless costs of labor and material should go considerably higher.

ILLINOIS HOBS



NONE BETTER CAN BE MADE

It is not our ambition to make all the Hobs used in industry; only to make the best.

ILLINOIS TOOL WORKS, CHICAGO.

Detroit Store—*
Woodward and Warren Aves.
A. C. Towne, Inc.*
17 W. Swan St., Buffalo.

S. J. Pfaff
Pioneer Bldg., St. Paul.
Rose Tool and Supply Co.*
111 Market St., Pittsburgh.

Louis G. Henes*
75 Fremont St., San Francisco.
Title Insurance Building,
Los Angeles.

Indianapolis Office
616 Fletcher Sav. & Trust Bldg.
New York Office
141-145 West 36th St.

*Complete Stock carried at Detroit—Buffalo—Pittsburg and San Francisco.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON

Grey forge, Pittsburgh	$31 00
Lake Superior, charcoal, Chicago	38 40
Standard low phos., Philadelphia	40 00-40 00
Bessemer, Pittsburgh	3' 50
Basic, Valley furnace	30 00
Toronto price:—	
Silicon..2.25% to 2.75%	$34.00 to $37.00

IRON AND STEEL

Per lb. to Large Buyers	Cents
Iron bars, base, Toronto	$ 4 25
Steel bars, base, Toronto	4 25
Steel bars, 2 in. to 4 in. base	5 50
Steel bars, 4 in. and larger base	6 00
Iron bars, base, Montreal	3 75
Steel bars, base, Montreal	3 75
Reinforcing bars, base	4 50
Steel hoops	5 50
Norway iron	11 00
Tire steel	5 50
Spring steel	8 00
Brand steel, No. 10 gauge, base	4 40
Chequered floor plate, 3-16 in.	7 50
Chequered floor plate, ¼ in.	7 00
Staybolt iron	8 00
Bessemer rails, heavy, at mill	
Steel bars, Pittsburgh	2 35
Tank plates, Pittsburgh	2 65
Structural shapes, Pittsburgh	2 45
Steel hoops, Pittsburgh	3 05
F.O.B., Toronto Warehouse	
Small sapes	4 25
F.O.B. Chicago Warehouse	
Steel bars	3 62
Structural shapes	3 72
Plates	3 90
Small shapes under 3"	3 62

FREIGHT RATES

Pittsburgh to Following Points	Per 100 Pounds. C.L.	L.C.L.
Montreal	33	45
St. John, N.B.	41½	55
Halifax	49	64½
Toronto	27	39
Guelph	27	39
London	27	39
Windsor	27	39
Winnipeg	89½	135

METALS

	Gross.	
Lake copper	$24 25	$25 00
Electro copper	24 00	25 00
Castings, copper	23 50	25 00
Tin	57 50	58 00
Spelter	10 00	10 50
Lead	8 25	8 50
Antimony	10 50	10 50
Aluminum	33 00	35 00

Prices per 100 lbs.

PLATES

	Montreal	Toronto
Plates, ½ up	$ 5 00	$ 5 00
Plates, 3-16 in.	5 25	5 25

Price List No. 38

WROUGHT PIPES

Standard Buttweld

⅛ in.	$ 6 00	$ 8 00
¼ in.	4 68	6 81
⅜ in.	4 68	6 81
½ in.	6 21	7 78
¾ in.	7 82	9 95
1 in.	11 56	14 71
1¼ in.	15 64	19 90
1½ in.	18 70	23 76
2 in.	25 16	32 01
2½ in.	40 37	51 19
3 in.	52 79	66 94
3½ in.	67 16	84 18
4 in.	79 57	99 74

Standard Lapweld

2 in.	38 81	35 34
2½ in.	42 12	52 36
3 in.	55 08	68 47
3½ in.	69 00	86 94
4 in.	81 75	103 00
4½ in.	93	1 18
5 in.	1 08	1 37
6 in.	1 40	1 78
7 in.	1 83	2 32
8L in.	1 93	2 44
8 in.	2 22	2 81
9 in.	2 66	3 36
10L in.	2 46	3 12
10 in.	3 17	4 02

Terms 2% 30 days, approved credit.

Freight equalized on Chatham, Guelph, Hamilton, London, Montreal, Toronto, Welland.

Prices—Ontario, Quebec and Maritime Provinces

WROUGHT NIPPLES

4" and under, 60%.
4½" and larger 50%.
4" and under, running thread, 30%.
Standard couplings, 4" and under, 40%, 4½" and larger, 20%.

OLD MATERIAL

Dealers' Average Buying Prices.

	Per 100 Pounds. Montreal	Toronto
Copper, light	$14 00	13 75
Copper, crucible	17 00	17 00
Copper, heavy	17 00	17 00
Copper wire	17 00	17 00
No. 1 machine composition	15 25	16 00
New brass cuttings	11 00	10 75
Red brass cuttings	14 00	14 75
Yellow brass turnings	8 00	9 00
Light brass	6 25	7 00
Medium brass	7 25	7 75
Scrap zinc	6 00	6 00
Heavy lead	5 00	6 00
Tea lead	3 75	3 50
Aluminum	18 00	18 00
	Per Ton	Gross
Heavy melting steel	13 50	16 00
Boiler plate	13 50	11 00
Axles (wrought iron)	20 00	20 00
Rails (scrap)	14 50	16 00
Malleable scrap	18 00	20 00
No. 1 machine cast iron	24 00	25 00
Pipe, wrought	9 00	9 00
Car wheels	20 00	20 00
Steel axles	20 00	20 00
Mach. shop turnings	7 00	11 00
Stove plate	22 00	21 00
Cast boring	10 00	11 00

BOLTS, NUTS AND SCREWS

	Per Cent.
Carriage bolts, ⅜" and less	35
Carriage bolts, 7-16 and up	15
Coach and lag screws	50
Stove bolts	65
Wrought washers	50
Elevator bolts	25
Machine bolts, 7-16 and over	40
Machine bolts, ⅜" and less	40
Blank bolts	25
Bolt ends	25
Machine screws, fl. and rd. hd., steel	27½
Machine screws, o. and fil. hd., steel	10
Machine screws, fl. and rd. hd., brass	net
Machine screws, o. and fil. hd., brass	net
Nuts, square blank	add $0
Nuts, square, tapped	add 1
Nuts, hex., blank	add 1
Nuts, hex., tapped	add 1
Copper rivets and burrs, list less	15
Burrs only, list plus	25
Iron rivets and burrs	40 and
Boiler rivets, base ¾" and larger	$8
Structural rivets, as above	8
Wood screws, O. & R., bright	75
Wood screws, flat, bright	77
Wood screws, flat, brass	55
Wood screws, O. & R., brass	55
Wood screws, flat, bronze	50
Wood screws, O. & R., bronze	47

MILLED PRODUCTS

(Prices on unbroken packages)

	Per Cent.
Set screws	50
Sq. and Hex. Head Cap Screws	45
Rd. and Fil. Head Cap Screws	20
Flat But. Hd. Cap Screws	10
Fin. and Semi-fin. nuts up to 1 in.	45
Fin. and Semi-fin. nuts, over 1 in., up to 1½ in.	40
Fin. and Semi-fin. nuts over 1½ in., up to 2 in.	25
Studs	30
Taper pins	50
Coupling bolts	10
Planer head bolts, without fillet, list	10
Planer head bolts, with fillet, list plus 10 and	net
Planer head bolt nuts, same as finished nuts.	
Planer bolt washers	net
Hollow set screws	net
Collar screws	list plus 20, 30
Thumb screws	40
Thumb nuts	75
Patch bolts	add 20
Cold pressed nuts to 1½ in.	add $1 00
Cold pressed nuts over 1½ in.	add 2 00

BILLETS

	Per gross ton
Bessemer billets	$46 00
Open-hearth billets	46 00
O.H. sheet bars	46 00
Forging billets	56 00
Wire rods	52 00

Government prices.
F.O.B. Pittsburgh.

NAILS AND SPIKES

Wire nails	$4 70
Cut nails	4 75
Miscellaneous wire nails	60%
Spikes, ⅜ in. and larger	$7 50
Spikes, ¼ and 5-16 in.	8 00

ROPE AND PACKINGS

Drilling cables, Manila	0 39
Plumbers' oakum, per lb.	0 10
Packing, square braided	0 38
Packing, No. 1 Italian	0 44
Packing, No. 2 Italian	0 36
Pure Manila rope	0 37
British Manila rope	0 31
New Zealand hemp	0 31
Transmission rope, Manila	0 43
Cotton rope, ¼-lb. and up	0 74

POLISHED DRILL ROD

Discount off list, Montreal and Toronto	net

WANTED

Young man who can write advertisements for mechanical lines.

We have an opening for a man who understands machinery and who can write intelligently and convincingly. One who has had advertising experience preferred.

Give, in the first instance, full particulars as to age, education, experience, etc. Applications will be treated in confidence.

Canadian Machinery

153 University Avenue

TORONTO, ONT.

If interested tear out this page and place with letters to be answered.

MISCELLANEOUS

Solder, strictly	$ 0 34
Solder, guaranteed	0 39
Babbitt metals	18 to 70
Soldering coppers, lb.	0 58
Lead wool, per lb.	0 14
Putty, 100-lb. drums	6 75
White lead, pure, cwt.	17 80
Red dry lead, 100-lb. kegs, per cwt.	15 50
Glue, English	0 35
Tarred slater's paper, roll	1 30
Gasoline, per gal., bulk	0 33
Benzine, per gal., bulk	0 32
Pure turpentine, single bbls., gal.	1 50
Linseed oil, raw, single bbls.	2 90
Linseed oil, boiled, single bbls.	2 92
Plaster Paris, per bbl.	4 50
Sandpaper, B. & A.	List plus 43
Emery cloth	List plus 37½
Sal Soda	0 03½
Sulphur, rolls	0 05
Sulphur, commercial	0 04½
Rosin "D," per lb.	0 07
Rosin "G," per lb.	0 08
Borax crystal and granular	0 14
Wood alcohol, per gallon	2 00
Whiting, plain, per 100 lbs.	2 50

CARBON DRILLS AND REAMERS

S.S. drills, wire sizes up to 52	40
S.S. drills, wire sizes, No. 53 to 80	50
Standard drills, all sizes	50
3-fluted drills, plus	10
Jobbers' and letter sizes	50
Bit stock	40
Ratchet drills	15
S.S. drills for wood	40
Wood boring brace drills	25
Electricians' bits	30
Sockets	50
Sleeves	50
Taper pin reamers	net
Drills and countersinks	list plus 10
Bridge reamers	50
Centre reamers	10
Chucking reamers	net
Hand reamers	10
High speed drills, list plus	10 to 40
Canadian high speed cutters	net
American	plus 40

COLD ROLLED SHAFTING

At mill list plus 5%
At warehouse list plus 25%
Discounts off new list. Warehouse price at Montreal and Toronto

IRON PIPE FITTINGS

Malleable fittings, class A, 20% on list; class B and C, net list. Cast iron fittings, 15% off list. Malleable bushings, 25 and 7½%; cast bushings, 25%; unions, 45%; plugs, 20% off list. Net prices malleable fittings; class B black, 24½c lb.; class C black, 15¾c lb.; galvanized, class B, 34c lb.; class C, 24½c lb. F.O.B. Toronto.

SHEETS

	Montreal	Toronto
Sheets, black, No. 28	$ 6 55	$ 6 75
Sheets, black, No. 10	6 00	6 00
Canada plates, dull, 52 sheets	8 50	7 10
Can. plates, all bright.	8 50	8 00
Apollo brand, 10¾ oz. galvanized		
Queen's Head, 28 B.W.G.		
Fleur-de-Lis, 28 B.W.G.		
Gorbal's Best, No. 28		
Colborne Crown, No. 28.		
Premier, No. 28 U.S.		8 20
Premier, 10¾ oz.		8 50
Zinc sheets	20 00	20 00

PROOF COIL CHAIN

(Warehouse Price)

B

¼ in., $13.00; 5-16, $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ¼ in., $9.75; ⅞ in., $9.20; ¾ in., $9.30; ⅝ in., $9.50; 1 in., $9.10; Extra for B.B. Chain, $1.20; Extra for B.B.B. Chain, $1.80.

ELECTRIC WELD COIL CHAIN B.B.

⅛ in., $16.75; 3-16 in., $15.40; ¼ in., $13.00; 5-16 in., $11.00; ⅜ in., $10.00; 7-16 in., $9.80; ½ in., $9.75; ⅝ in., $9.50; ¾ in., $9.30.

Prices per 100 lbs.

FILES AND RASPS

	Per Cent.
Globe	50
Vulcan	50
P.H. and Imperial	50
Nicholson	32½
Black Diamond	27½
J. Barton Smith, Eagle	50
McClelland, Globe	50
Delta Files	20
Disston	40
Whitman & Barnes	50
Great Western-American	50
Kearney & Foot, Arcade	50

BOILER TUBES.

Size.	Seamless	Lapwelded
1 in.	$27 00	$.....
1¼ in.	29 00	
1½ in.	30 00	26 50
1¾ in.	32 00	26 50
2 in.	31 00	26 00
2¼ in.	35 00	28 00
2½ in.	43 00	32 00
3 in.	48 00	40 00
3½ in.		41 00
3½ in.	60 00	42 00
4 in.	75 00	56 00

Prices per 100 ft., Montreal and Toronto

OILS AND COMPOUNDS.

Castor oil, per lb.	
Royalite, per gal., bulk	22½
Palacine	25½
Machine oil, per gal.	36
Black oil, per gal.	16
Cylinder oil, Capital	62
Cylinder oil, Acme	45
Standard cutting compound, per lb.	0 06
Lard oil, per gal.	$2 60
Union thread cutting oil, antiseptic	88
Acme cutting oil, antiseptic	37½
Imperial quenching oil	39½
Petroleum fuel oil, bbls. net	8

BELTING—No 1 OAK TANNED

Extra heavy, single and double	30%
Standard	30, 10%
Cut leather lacing, No. 1	2 20
Leather in sides	1 75

TAPES

Chesterman Metallic, 50 ft.	$2 00
Lufkin Metallic, 603, 50 ft.	2 00
Admiral Steel Tape, 50 ft.	2 75
Admiral Steel Tape, 100 ft.	4 45
Major Jun. Steel Tape, 50 ft.	3 50
Rival Steel Tape, 50 ft.	2 75
Rival Steel Tape, 100 ft.	4 45
Reliable Jun. Steel Tape, 50 ft.	3 50

PLATING SUPPLIES

Polishing wheels, felt	4 00
Polishing wheels, bull-neck	2 25
Emery in kegs, American	06
Pumice, ground	06
Emery glue	35
Tripoli composition	09
Crocus composition	12
Emery composition	10
Rouge, silver	50
Rouge, powder, nickel	45

Prices per lb.

ARTIFICIAL CORUNDUM

Grits, 6 to 70 inclusive	.08½
Grits, 80 and finer	.6

BRASS—Warehouse Price

Brass rods, base ½ in. to 1 in. rod	0 34
Brass sheets, 24 gauge and heavier, base	$0 42
Brass tubing, seamless	0 46
Copper tubing, seamless	0 48

WASTE

XXX Extra	19½	Atlas	17
Peerless	19	X Empire	15½
Grand	18	Ideal	16
Superior	18	X Press	14
X L C R	17		

Colored

Lion	15	Popular	12
Standard	13½	Keen	10½
No. 1	13½		

Wool Packing

Arrow	25	Anvil	15
Axle	20	Anchor	11

Washed Wipers

Select White	11	Dark colored	09
Mixed colored	10		

This list subject to trade discount for quantity.

RUBBER BELTING

Standard ... 10% Best grades ... 15%

ANODES

Nickel	.58 to .65
Copper	.38 to .45
Tin	.70 to .70
Zinc	.18 to .18

Prices per lb.

COPPER PRODUCTS

	Montreal	Toronto
Bars, ½ to 2 in.	$42 50	$43 00
Copper wire, list plus 10.		
Plain sheets, 14 oz., 14x60 in.	46 00	44 00
Copper sheet, tinned, 14x60, 14 oz.	48 00	48 00
Copper sheet, planished, 16 oz. base	46 00	45 00
Braziers', in sheets, 6 x 4 base	45 00	44 00

LEAD SHEETS

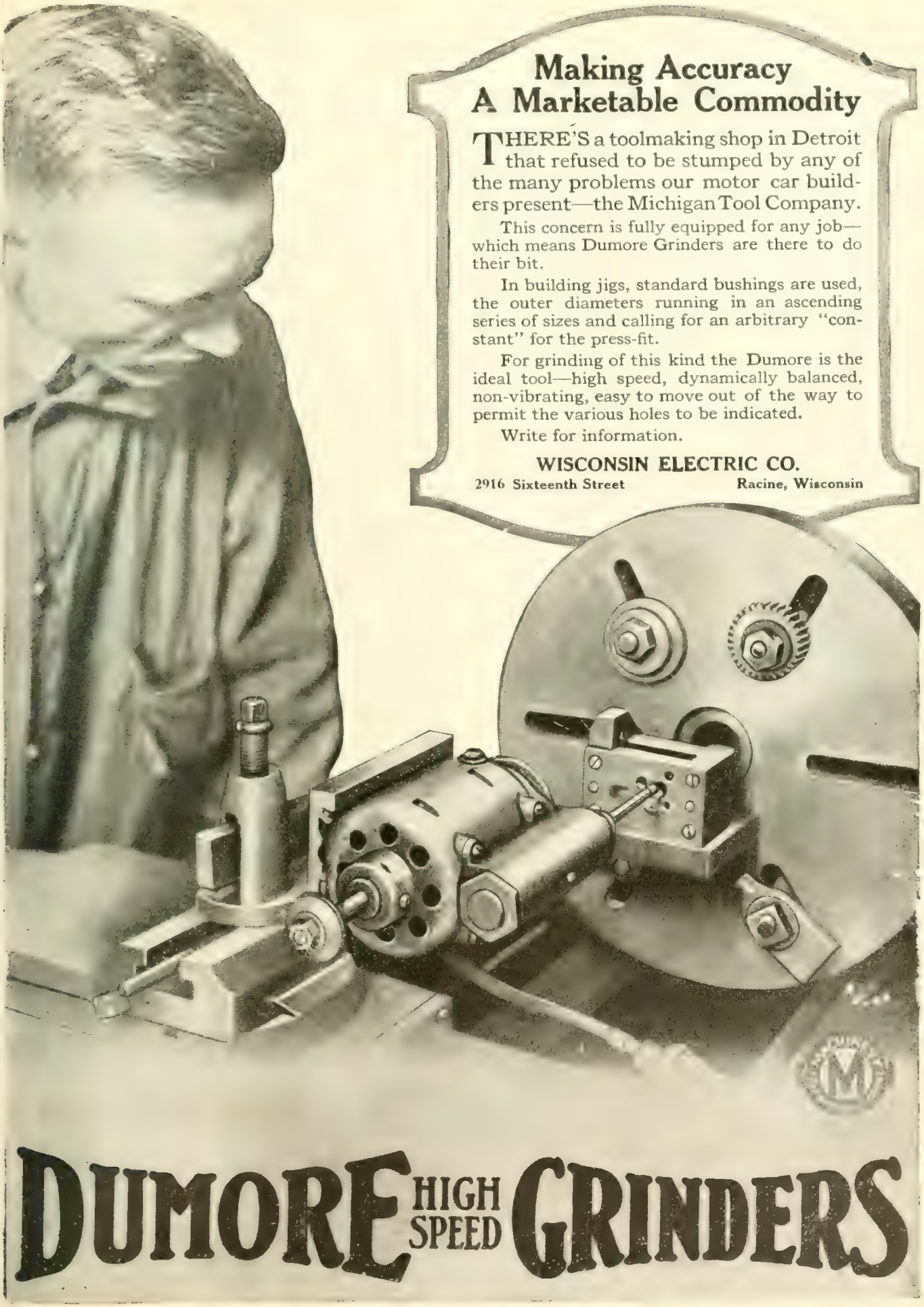
	Montreal	Toronto
Sheets, 3 lbs. sq. ft.	$10 75	$11 50
Sheets, 3½ lbs. sq. ft.	10 50	11 00
Sheets, 4 to 6 lbs. sq. ft.	10 25	10 50

Cut sheets, ½c per lb. extra.
Cut sheets to size, 1c per lb. extra.

PLATING CHEMICALS

Acid, boracic	$.25
Acid, yhdrochloric	.04
Acid, nitric	.10
Acid, sulphuric	.04
Ammonia, aqua	.13
Ammonium, carbonate	.20
Ammonium, chloride	.22
Ammonium hydrosulpuret	.50
Ammonium sulphate	.30
Arsenic, white	.14
Copper, carbonate, annhy	.41
Copper, sulphate	.16
Cobalt, sulphate	.20
Iron perchloride	.62
Lead acetate	.30
Nickel ammonium sulpate	.16
Nickel carbonate	.32
Nickel sulpate	.18½
Potassium carbonate	.50
Potassium sulphide (substitute)	.42
Silver chloride (per oz.)	1.25
Silver nitrate (per oz.)	1.20
Sodium bisulphate	.18
Sodium carbonate crystals	.06
Sodium cyanide, 127-130%	.38
Sodium hyposulphite per 100 lbs	8.00
Sodium phosphate	.18
Tin chloride	1.75
Zinc chloride, C.P.	.30
Xinc sulphate	.03

Prices per lb. unless otherwise stated



Making Accuracy A Marketable Commodity

THERE'S a toolmaking shop in Detroit that refused to be stumped by any of the many problems our motor car builders present—the Michigan Tool Company.

This concern is fully equipped for any job—which means Dumore Grinders are there to do their bit.

In building jigs, standard bushings are used, the outer diameters running in an ascending series of sizes and calling for an arbitrary "constant" for the press-fit.

For grinding of this kind the Dumore is the ideal tool—high speed, dynamically balanced, non-vibrating, easy to move out of the way to permit the various holes to be indicated.

Write for information.

WISCONSIN ELECTRIC CO.

2916 Sixteenth Street Racine, Wisconsin

DUMORE HIGH SPEED GRINDERS

If interested tear out this page and place with letters to be answered.

Labor Paper Says Steel Strike Has Failed

But There Has Been a Tremendous Loss in the Struggle—The Failure of the Radicals Has Cost $280,000,000—More Labor-Saving Machinery Brought Out

PITTSBURGH. — Authentic reports from the Pittsburgh district on conditions resulting from the steel strike called Sept. 22, ten weeks ago, show that the strike has been a distinct failure and that the steel companies for the most part now are contending simply with the imperfect shop organization inevitably accompanying operation with a large percentage of men not yet familiar with their jobs. This difficulty obviously is becoming less serious each day. Of the 228,430 mill workers employed in this the steel centre of Americea, 162,474 either failed to report for work or were sent home the first day of the strike. Out of this latter number 109,455 are back at work.

During the ten weeks of the strike, seven lives were lost, one man was paralyzed as a result of being struck on the head with a brick, and 173 were injured in riots, street fights or clashes between pickets and workmen and guards.

A conservative estimate places the total payroll loss in the entire district at $29,634,064.67, and property loss at $153,150. The only figures obtainable as to the tonnage loss by the steel company are those given by the strike committee, which places it at $250,000,000.

Not 1 Per Cent. of Strikers Idle

It is estimated less than 1 per cent. of the men who struck are idle to-day. Most of them have returned to their old jobs. Others have gone elsewhere to work. Many foreign workers have returned to their native land.

As a result of the strike, the labor situation is more serious in this district than it was during the war. Workmen going back to Europe, or leaving this region to find employment elsewhere, have created a shortage of almost 30,000 common laborers. The longshoremen's strike in New York has served to prevent many mill workers from returning to Europe, and as soon as that difficulty is settled a rush to Europe is expected.

Steel officials say the problem of insufficient laborers is being met in various ways. Many negroes, Greeks and Mexicans have been brought into the district since the strike. Significant are reports showing that the strike has stimulated inventiveness in the management of steel plants, with the result that new methods were devised whereby fewer men than formerly are required to perform certain work. These labor-saving methods will continue to be used.

Labor scarcity does not exist in all steel towns, for some mills have more applications than they have jobs.

Many independent steel plants throughout the district were compelled to shut down because of the crane operators and electrical workers being called out on strike, thus making it impossible for other parts of the plant to continue operations. In the course of a week the places of most of the strikers were fillled. Some of the crane operators now are receiving as high as $225 monthly.

Difficulties Are Surmounted

At the Clairton Steel Works, where clashes of strikers and State police caused much excitement, 500 laborers walked out September 22, in response to the strike order. These men were an important cog in a vast machine, and their absence necessitated a shutdown of the works, employing 4,300 men. A new organization had to be effected. For weeks the plant ran far below capacity, but new departments were added from time to time until now the plant is running 100 per cent., not only in the steel works, but in the by-product plant. The experience of the Clairton Works is typical.

In the Clairton by-products plant, an average of one car of coke is made every six minutes throughout the twenty-four hours of the day. This plant supplies coke for the Clairton, Homestead, Braddock and Duquesne works, and also provides much of the gas used in these plants. The gas is a byproduct in the transformation of coal into coke.

From the beginning of the strike, it was evident to steel officials and others that a large percentage of the strikers were not idle from choice. Prior to the actual calling of the strike, there was no question but that the sentiment in favor of striking was overwhelming. Many of the workmen were agitators of the I.W.W. type. Hundreds of others, vaguely feeling themselves victims of an unfair economic system, were easy prey for these agitators. Still other hundreds were of the kind that always may be depended upon to "go with the crowd."

Many joined enthusiastically in the strike, not because they felt that they had a grievance, but because they expected it to be successful and to result in their being better off than before. All believed that the strike would be short.

Radicalism Killed Strike

Among the reasons for the collapse of the strike in this district, the radical character of its leadership and the failure to pay promptly promised strike benefits stand out prominently. The pamphlet on Syndicalism written by William Z. Foster, secretary-treasurer of the national strike committee, entered the limelight soon after the beginning of the strike, and it became a subject of general discussion, revealing the fact, for the first time, to thousands of strikers and their sympathizers the kind of man who was managing the gigantic walkout. With this realization there grew rapidiy among the striking workmen a conviction that they had allowed themselves to be used as "tools."

During October the American Sheet and Tin Plate Company of Vandergrift, which was closed by the strike, had the largest production in the history of the company.

The Wheeling district is the only one idle to-day. However, steel company officials say the backbone of the strike has been broken, as the hot mill men of the Laughlin plant of the American Sheet and Tin Plate Company in Martins Ferry and the La Belle plant of the same company in Wheeling, as well as the Aetna Standard in Bridgeport, have voted to return to work. All three of these plants own and operate their own coal mines, and until the coal situation is adjusted, there can be no resumption of operations in any of the big mills. The men of the Riverside plant of the National Tube Company in Benwood have voted to return to work, but no definite steps for a resumption have been taken by the company.

In Wheeling, the union commissary will supply more than 600 needy families of union strikers with foodstuffs during the week. Three weeks ago, the steel workmen's organization began disposing of food. At that time there were only 125 families. In two weeks the number jumped almost to 500, and it is expected that the number will double weekly until the strikers return to work.

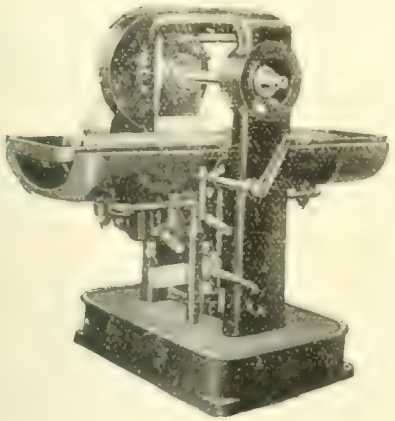
The commissary was installed in Youngstown instead of the promised financial benefits. Whenever this commissary is open, there are many women and children standing in line awaiting their turn to be served.

In its current issue, the West Virginia Labor News admits that the steel strike has collapsed, and admits the full resumption of operations at various plants, following agreement by the strikers to abandon their officials and return to work on the open shop basis. The News has been backing the steel workers in their strike.

The death is announced at his home in Haileybury of Mr. J. W. Moffet. The deceased was well known in the mining district, having erected mills at the Penn-Canadian, Silver Cliff, and Beaver Mines in Cobalt, and the Kirkland Lake mines. Death was due to tuberculosis. Mr. Moffet was born in Missouri 74 years ago, and came to Cobalt in 1905. He is survived by a widow and one daughter.

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And so it is. A man who is unfamiliar with the "Briggs" and the work of which it is capable is always surprised at the power available and the extreme rigidity on any milling operation which is within the range of this tool. It is a small machine; but the solid over-arm construction and the convenience of operation make it a manufacturing machine of unsurpassed production possibilities on all work which it can handle.

The low first cost of the Briggs Miller is another of its surprising features. The floor space required is small. Upkeep is slight, operating cost is low because skilled labor is not required to obtain the best output of which the machine is capable. And there are other advantages, too, which we'll be glad to explain in more detail.

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MONTREAL **TORONTO** **WINNIPEG**

The Week's Events in Montreal Industry

The Mason Regulator and Engineering Co., of Montreal, has secured the agency for the Republic Flow Meter.

Roderic J. McLean, engineer, of Montreal, has obtained the agency for the T. J. Wing Manufacturing Co., 352 West 13th Street, New York, manufacturers of engine and boiler room equipment.

An order recently received from the Norwegian Government by the Canadian Vickers Co., for a large steel cargo vessel, is the second this company has had from this source in the past few months. This vessel is to be delivered by the close of May, 1920.

At a recent meeting of the Montreal branch of the C.A.S.E., the subject was the reading and discussion of a paper on D.C. current and equipment illustrated by a large number of slides. The evening was one of interest and instruction.

M. P. Fennell, secretary of the Montreal Harbor Commission, has been elected to the office of secretariat of the American Association of Port Authorities, and this office will now be transferred to this city. It is interesting to note that this is the first occasion that a Canadian has held this office.

A commercial club has recently been organized in the city of St. John, N.B., with an initial membership of nearly two hundred. S. E. Elkin, M.P., has been elected president, and with the assistance of an able executive the club proposes to arouse public sentiment and hasten action for the development of the city along modern lines.

The proposed plan to connect the Great Lakes with the sea by way of the St. Lawrence is again in the limelight. In addition to developing schemes for removing existing obstacles for deep water navigation on the river, the utilization of available hydro power is part of the present plan. The scheme would involve the overcoming of a fall of 220 feet in a distance of one hundred miles above Montreal.

Edward F. Sise has resigned from the position of chief executive of the Northern Electric Company after a long period of successful administration. He organized the Wire and Cable Co. in 1899, and was managing-director of that company when it was amalgamated with the Northern Electric Co. The presidency of the company has been filled by Paul F. Sise, who will now assume the duties of this office.

At the invitation of J. J. York, A.E.I.C., the Montreal branch of the Engineering Institute of Canada visited the St. Lawrence Sugar Refinery on Friday evening and Saturday afternoon (Nov. 28 and 29). The parties were shown over the plant by Mr. York in person, the whole trip requiring fully three hours. Raw sugar is received at wharf, coming by boat from West Indies. The shed can hold a month's supply, the daily capacity being over a million pounds of sugar. The parties followed the refining process from the receiving shed to the final boiling to granulated white sugar, and automatic packing as granulated sugar or manufacture into cube sugar.

Two 25,000-kilowatt steam-driven turbine units of the American Westinghouse make, which, when installed, will complete the largest steam-driven electrical installation in the Far East, are now being erected at Osaka, Japan, for the Osaka Electric Light Company. With its power station situated in an extensive industrial district, this company furnishes light and power to street railways, steel works, shipbuilders, copper refining plants, paper mills, electrochemical installations, and other industries. It may be mentioned that in 1908 the Osaka Company installed three steam turbine units of 3,000 kilowatts each. In 1910 two more units of like capacity were added, and in 1911 two 5,000-kilowatt units. The 25,000-kilowatt units now being installed will bring the capacity of the plant up to 100,000 horsepower.



INDUSTRIAL NEWS

NEW SHOPS, TENDERS AND CONTRACTS
PERSONAL AND TRADE NOTES



TRADE GOSSIP

Emergency Coal for Canada.—The handling of coal released to Canada by the United States administration has been arranged by the fuel section of the Canadian Trade Commission. Coal is expected to come across the border in the next few days. Hospitals and such public institutions will have the first attention, after which will come industries engaged in the manufacture of foodstuffs. There have been many applications to the board from industries wishing to be placed in the essential class, but the board referred these to the Provincial administration.

Coal Situation in Toronto.—If the strike continues in the United States for another ten days, 10 per cent. of the small industries in Toronto will be forced to close down. This is according to statement made by William McGill & Co., of this city. A further statement from the same source was to the effect that very little coal was coming into the city, and the coal obtained by the fuel controller was being devoted to the use of hospitals and public utilities. The large industries were in a better position, having, in most cases, enough coal to carry them through the winter.

Coal Commissioner for B.C.—W. G. Gaunce, of Victoria, has been appointed Controller of Export Licenses for British Columbia. Shipowners requiring bunkers for their vessels, if not registered in Canada, must get a license from the controller before they can obtain their requirements. Coal for export must also be licensed. There are only two kinds of licenses issued, the first for coal cargoes destined for U.S. and Alaska points, and the second for bunker coal for ships flying any flag and sailing for any destination, but only for sufficient quantity to take them to the foreign port.

Canadian Bridges Too Light.—Mr. Frank Barber, speaking before the Electrical Club recently in Toronto, expressed the opinion that most of the Canadian bridges were built too lightly. There were bridges in Europe that were older than the banks of the streams they were on. The life of a steel bridge was seldom more than fifty years, and the failure of this type of bridge was due to poor concrete abutments. The use of concrete would eventually supersede steel for bridges. The new bridge being built in Peterboro' would be erected with one hundred and fifty tons of steel and fifteen thousand yards of concrete.

THE F. F. BARBER MACHINERY CO. OPENS UP FOR BUSINESS IN TORONTO

ANNOUNCEMENT is made of the formation of the F. F. Barber Machinery Co., with offices on the fourth floor of the Foy Building, Front St. W., Toronto. Mr. Frank Barber, recently in charge of the machine tool department of the A. R. Williams Co., is at the head of the new company. "Our prime object," said Mr. Barber to CANADIAN MACHINERY, "is specialization. We propose to handle sufficent lines to cover



F. F. BARBER.
Pres. of F. F. Barber Machinery Co.

production equipment, as well as standard machine tool equipment. We propose to carry the leading lines of tools in each type. By doing this we feel that we can give both customers and makers a better class of service than has hitherto been possible." Mr. Barber is at present in the machine tool markets of United States, where he is completing arrangements for representing a number of machine tool lines in Canada.

Mr. Barber has been in the machinery business in various capacities for a number of years—the fact is he has never been away from the business in some form or another. His first experience came when he was "articled" to F. W. Hudlass at Southport, England, who founded and directed the Phoenix Motor Car Works, and was later appointed chief engineer for the Royal Automobile Club of Great Britain and Ireland. Being "articled" at that time meant among other things, putting up £50 to guarantee that the "article" would remain on the premises until his apprenticeship term had been fully served. Such things would not go in this land now, but they are relics of a stern school of technical training.

Coming to Canada late in 1903 Mr. Barber was for a short period with the Russell Motor Co., going shortly to the McLaughlin Engine Co. as a mechanic. The next move brought him to the tool room of Roden Bros., silversmiths, going from that firm to J. P. Cleal, where he had splendid scope to work on models and engage in the development of patents. Mr. Barber was finally in charge of the experimental work in this shop, many intricate devices and improvements resulting from the adaption of his drawings.

It was in the year 1911 that Mr. Barber left the practical side of the business, going to the Fairbanks-Morse Co., sales department. He took kindly to the change and the change took kindly to him. In the early part of 1915, when the equipping of war shops was becoming an acute and urgent problem in Canada, as well as in every country under the sun, Mr. Barber joined the A. R. Williams Machinery Co. in the machine tool department. In common with dealers who went through the avalanche of business that threatened to bury and swamp the trade, Mr. Barber was able to render splendid service to the munitions shops, as well as gain a tremendous amount of valuable knowledge on shop equipment, special machines for special operations, etc.

Sault Ste. Marie.—Five bodies of the crew of the ill-fated Myron have been picked up above Salt Point in Whitefish Bay. This is after nearly a week's patrol of the north and south shores of Lake Superior and Whitefish Bay. No word of their identity has been received as yet. The body of Albert Neilson, deckhand of the steamer Townsend, was found near the centre pier. He fell in the canal some weeks ago while assisting to moor the vessel.

Secord Gets Contract.—P. H. Secord & Co. have secured the contract for the four-storey building for the William Paterson Sons & Co. in Brantford.

Victoria, B.C.—The Marine Department are considering the building of two 75-foot motor boats to supplement its present British Columbia fleet. The work of drawing up the plans has been entrusted to the Cheberg Shipyards.

Port Arthur.—Mr. J. H. Smith will be the new manager of the Port Arthur Shipbuilding Company, replacing Mr. J. F. Paige. Mr. Smith has not yet arrived in Port Arthur, he being detained in Cleveland owing to the illness of a brother.

First Oil Locomotive.—The first French locomotive to generate steam by the use of oil fuel has been tried out successfully, a heavy train being hauled without difficulty. It is understood that following this trial two hundred locomotives will be equipped to burn oil instead of coal.

Board of Commerce to Act. — The Board of Commerce has given public notice that any complaints re high prices charged for bituminous coal, will be at once investigated. If the charge is proved, the Board will take steps to secure a conviction.

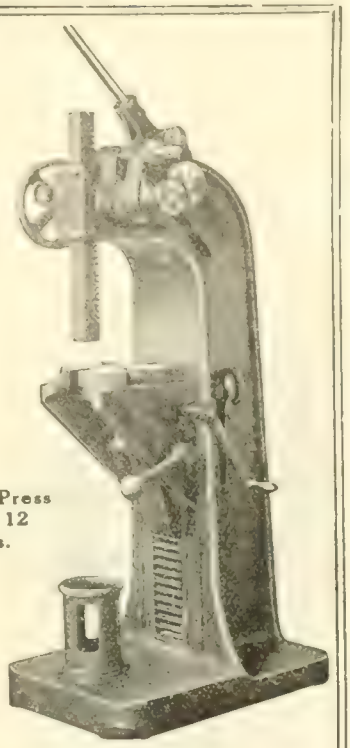
Coal Allowance Arrives.—The allowance of 150 carloads of bituminous coal daily, which was arranged for by the U. S. Fuel Administrator, started Dec. 1. The greater part of the first few days will be allotted to public utilities in various parts of Ontario.

To Build Bridge Approach.—The lines leading to the projected C.P.R. bridge over the Niagara River will be built by the Toronto, Hamilton & Buffalo Railway Co. The line will be from Welland to a point on the river six miles below Bridgeburg, where the bridge will be built.

British Trade for Canada.—Canadian manufacturers wishing to tender on business for British Government Department, will be sure of receiving the greatest consideration. The Admiralty, War Office, Ministry of Munitions, India Office and Crown Agents for all the colonies have signified their intention of considering Canadian offers for supplies purchased by them.

Baldwin's to Start Building.—It is understood that Baldwin's, Ltd., who have taken over the plant of the British Forgings at Ashbridge Bay, Toronto, will start the erection of two buildings immediately. Thes buildings are to be of considerable dimensions, one 800 feet long and the other 400. Other large buildings are being delayed owing to the shortage of structural steel.

To Take 50 Per Cent. of Space.—The British Ministry of Shipping, according to a report current in shipping circles, will requisition 50 per cent. of the cargo space of steamers sailing during the month of December. This is an increase of 15 per cent. over the requirements for November. The increase is probably due to the necessity of getting the grain moved over to England and Europe.


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British Columbia Lumber.—The exports of British Columbia lumber, excluding paper and wood pulp, during October amounted to 30,000,000 feet. Paper and wood pulp amounted to 20,500,000 pounds. 8,000,000 feet of lumber were shipped to Europe and the Orient and the remainder by rail to the United States. There is still a shortage of ships. South Africa is also in the market for B.C. lumber.

Terminals for Sydney, C.B.—In response to a visit of a deputation some time ago to Ottawa, an engineer has arrived here to look over the site for a terminal. A tentative selection has been made at Anderson's Point, and Parliament has voted $100,000 for the building of the wharf and terminal. Mr. Coutlee, the Government engineer, has also been visiting Glace Bay to look over some projected harbor improvements.

Ottawa.—The Canadian Government Merchant Marine will number twenty-three vessels before the end of the year, according to a statement by Mr. Alec Johnson, the Deputy Minister of Marine. The "Canadian Spinner," "Canadian Planter," "Canadian Settler," "Canadian Rancher," "Canadian Railer" and "Canadian Traveller" will be all delivered before December 31st. The "Canadian Navigator" has been handed over.

Control of Big Fleet.—An agreement has been made with the British Admiralty which definitely places control of the International Mercantile Marine Co. in the hands of the English directors. This agreement states that the company shall make it compulsory that Englishmen manage the ships, and that the directors shall be subjects and residents of the British Empire. The names of new directors must be submitted to the British Government for approval.

Employment Managers Organize.—The employment managers of Toronto met recently in the Social Service Building of Toronto University, and formed the Employment Managers' Association of Toronto. A proposed draft of the by-laws and constitution of the Association was put before the members, and was adopted with few amendments. The next general meeting will be held on Dec. 8th, and the election of officers will be held.

Increase for Expressmen.—The Canadian Express Company's employees demand for a new wage schedule has been met by a compromise offer. This includes an agreement on the two weeks' vacation question, and a general increase in wages. By this arrangement men receiving less than $100 per month would receive a 15 per cent. increase; those getting from $100 to $110 a 12 per cent. increase, and all getting over $110 an increase of 10 per cent. This will be accepted by the men.

Arrange Emergency Coal Supply.—

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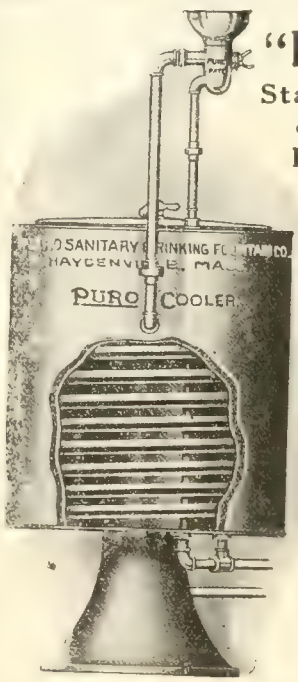
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An arrangement has been made by Mr. McGrath, Canadian Fuel Commissioner, by which an allotment of bituminous coal will be available to Canada. The procedure necessary in obtaining a supply is as follows: Preferred industries in Canada must have their applications substantiated by C. A. Magrath, Ottawa, after which the applications will be forwarded to the Canadian War Mission at Washington and by the Mission to the Central Fuel Committee.

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Pig Iron Production.—The growth of pig iron production in the United States has been remarkable in the last few years. According to the National Bank of Commerce the United States now produces half of the pig iron output of the world. The output has grown from 14,000,000 tons in 1913 to 39,000,000 tons in 1918. The annual production of pig iron has a greater value than any other single manufactured product in the country, or of all the rest of the metals produced.

Fort William.—The "E. D. Kingsley," built by the Canadian Car & Foundry Co. here, made a successful trial trip recently. The vessel, which is an oil burning freighter, developed a speed of 13½ miles per hour on her trial trip. The Kingsley took on a cargo of 30,000 bushels of grain for Montreal after the completion of the trial, and after discharging this cargo in Montreal, will go in the West India trade for two or three months. She will then proceed to Vancouver by the Panama Canal.

Leaside Munition Plant.—An effort is being made to preserve the buildings at Leaside belonging to the American Munitions Board, and Colonel Stuart of the U. S. War Department has been conferring with Mayor Church on the matter. Colonel Stuart stated that the U. S. War Board would rather sell the buildings than tear them down, but so far had been unable to find a purchaser. As the ground lease runs for only a short period the buildings will have to be removed before the lease expires unless they can be sold.

To Open St. Lawrence Navigation.—The experts for the Dominion and United States Governments who are examining the Rivers St. Lawrence and Ottawa, for purpose of submitting report to the International Joint Commission, have got their report ready. It is now in the hands of the Joint Committee for consideration, and meetings will be held soon of all the interested parties on both sides of the St. Lawrence, with a view to action being taken to make the upper reaches of the river and the Great Lakes accessible to ocean-going ships.

Exhibition of Canadian Industries.—The Canadian Manufacturers' Association has circulated its membership on the subject of being represented at the Canadian Industries Exhibition, to be held in the Royal Agricultural Hall, London, England, from June 3rd to June 17th next. Mr. Lloyd Harris, who is now in Canada, supports the movement strongly, as one holding great possibilities for Canadian foreign trade. Mr. H. Greville Montgomery, who has offices in Toronto, will allot space and transportation and attend to the details for Canadian exhibitors.

Moulders Are Out.—In accordance with the terms of their ultimatum to the management two days ago, the moulders and coremakers employed by the Dominion Iron and Steel Company, at Sydney, together with the apprentices in the company's foundry, quit work. Forty-one men are concerned. The men's demand is for a wage increase which the company has claimed cannot be made at this time of unsettled conditions in the steel trade. International headquarters of the moulders' union instructed the men to negotiate further, and this was followed by the men's notice to the company that unless the demands were met in forty-eight hours they would go out.

Changes in C.F.M. Staff.—W. J. Legge has been appointed manager of the machine tool department of the Canadian Fairbanks-Morse Co. at Montreal. He was formerly in the machine tool department at Toronto. The small tool and supply department of the Toronto branch of the Fairbanks-Morse has been organized apart from the machine tool department, and is in charge of P. E. Thring, who has recently returned from service overseas. E. E. Turner, of the machine tool department of the C.F.M., Montreal, has left for various plants in United States, where he will remain studying special production problems for the next three months. It is the intention to have Mr. Turner doing development and investigation work in Canadian shops where production on a quantity basis is possible.

MARINE

Fort William.—The grain rate for December loading will be five and possibly six cents, instead of three and a half cents prevailing in November. Regular marine insurance ceases at 1 o'clock November 30.

Cleveland.—Latest news of the Tioga, ashore near Calumet, is that she is pounding to pieces. She has been abandoned by her owners to the underwriters as a total loss. The crew left her the day after she stranded. Her wheat, valued at $250,000.

Port Huron. — The liner Hamonic, which was in the river here on Saturday, cast off and went out into the lake during the heavy gale. Her captain preferred to be clear of the narrow waters, where he had no room to manoeuvre, and feared being blown aground and damaged.

Calumet, Mich.—The steamer Tioga of Superior is hard aground three miles east of Eagle River, and leaking badly. She was driven ashore in a heavy snow storm, and with the heavy northwest wind that was blowing at the time, she was in danger of breaking up. Last reports give eight feet of water in her hold.

Fort William.—Tugs are busy keeping the harbor open until the close of navigation. The steel tugs Strathmore and Strathbell have been working for some days breaking the ice as it forms, and the tug E. C. Whalen is being brought along to assist them now the weather is colder. If necessary, the Grant will also be employed.

WORST STORM SINCE 1913 BLOW

The Westmount Battles Through and Runs Into an 80-Mile Gale

Fort William.—Capt. Davis, of the Canadian steamer "Westmount," which left Sault Ste. Marie for Fort William Saturday, passed through what he described as the worst storm since the great blow of November, 1913. The Westmount arrived in Fort William early in the morning.

According to Capt. Davis, the barometer dropped to 7.8, and just off Caribou Island he ran into an 80-mile N.E. gale, with blinding snow. Frost from water made vision impossible for more than a ship's length. The thermometer registered 20 degrees below zero, and the spray froze as it touched the decks and rigging. The Westmount was sheathed in ice in a few minutes. Tons of ice were shipped from the decks on arrival here.

Capt. Davis reported Slat Island Light extinguished.

CANADIAN PIG IS SELLING IN U.S.

Looks as Though There Might be a Runaway as Far as Prices are Concerned

New York Dec. 4.—Some symptoms of a runaway market in pig iron have appeared, but as the main pressure is for early delivery and the supply of such iron is not large, the scramble has been limited. In next year's iron there is not yet the general buying nor the general willingness to sell that combine to produce a broad movement.

In basic iron a sale of 15,000 tons to a plate manufacturer is reported at Philadelphia at $31.25, delivered, and sales of 10,000 tons in the Pittsburgh district were at $30 at furnace. No. 2 foundry has sold in the Central West in considerable lots at $32 at furnace for the first half. One Alabama seller opened its books for 1920, but after selling 23,000 tons at $31 at furnace, an advance of $2 withdrew from the market. Heavy inquiries have come up in central territory particularly from the Detroit district.

The sales of Canadian pig iron to melters in the United States have been considerable. Shipments from the Soo furnaces in Ontario, together with recent sales, make a total of 45,000 tons to the Chicago district, besides 15,000 tons for the Pacific coast. The Port Colborne, Ont., furnace has also made sizeable shipments to this side.

Estimates that the railroads will buy 1,000,000 tons of rails when they are turned back are considered conservative in view of tentative inquiries by the Pennsylvania and New York Central Lines. In the Chicago district pending inquiries amount to 250,000 tons. The Algoma mill has an order for 80,000 tons for the Canadian Pacific. In view of the car and motive power scarcity that is already menacing winter distribution of fuel and steel, figures for next year's needs exceeding 200,000 for cars and 5,000 for locomotives are not considered excessive.

DISPUTE OVER PLANT VENTILATION

Echo of Some of the Processes Used In the Making of Munitions

Ottawa.—The first case heard in the Supreme Court was Scotland vs. Canadian Cartridge Company. The appellant was employed in respondent's munition factory at making brass shells for cartridges, part of his duty being to dip the shells in baths of sulphuric acid and cyanide of potassium. After four months of employment he was taken ill and the doctors decided that inhalation of noxious gases was the cause. He brought an action for damages, basing it on the ground that defendants had not complied with the provisions of the Factory Act in the ventilation of the room in which he worked.

The jury found the defendants negligent as to ventilation, and a verdict was entered against them for $3,500.

The Appellate Division set it aside and dismissed the action, holding that plaintiff had failed to prove negligence.

Judgment was reserved.

DESIGNING THE RAILWAY TRACK

Great Attention Must Be Given This Work to Secure Best Running Results

In a paper on "Railway Track Design and Manufacture," read at the meeting of the Montreal branch of the Engineering Institute of Canada, Mr. W. E. L. Dyer referred to track construction as a branch of engineering as important as that of location, especially in view of the very large amount of capital invested in roadbeds. He then traced the development of the different forms of rails, and of spikes, chairs, fish-plates, and angle-bars. Efforts, he said, had been made to eliminate joints, but without success. The lap joint initiated by the C.P.R. was being adopted by some of the American companies.

Crossing failures were sometimes due to faulty foundations, and he advocated the use of concrete foundations for crossings. It was not generally known how accurately intersections had to be calculated and designed; many of the larger intersections required a week for calculation, and after that they had to be designed. The hard steel frog was introduced into Canada by Mr. Blackwell, one of the presidents of the institute.

Mr. Dyer discussed in detail the use of solid manganese steel, which was more expensive as to first cost, but which had many points to recommend it as to use.

ORGANIZATION OF TOOL DEALERS SHOULD BE NATIONAL IN SCOPE

COMMENCING on an interview with one of the Toronto machine tool dealers in last week's "Canadian Machinery" to the effect that there should be an association of dealers in Toronto, another dealer stated this week: "I noticed what was said in the last issue of CANADIAN MACHINERY in regard to a local organization of machine tool dealers to deal with various selling problems. If such a thing were undertaken the best results would follow from an organization that would take in the whole Dominion. In such a body there could be divisions, with a centre at Toronto, another at Montreal, one at Winnipeg and another at the coast. In this way I believe something might be accomplished on a larger scale than just arranging differences in selling campaigns. I do not see any good reason why the makers of machinery and machine tools in this country could not have a membership in such an organization. It might help the makers and dealers to get together occasionally and have a better understanding of each other's problems."

Still another dealer, speaking of the matter, stated that some sort of an organization could be of advantage in keeping makers of machinery from playing one house against another. "Not so very long ago the representative of a certain firm came to my office," he stated, "and told us that they were not going to stand for the representation that a certain other house had been giving them. This gentleman intimated that he wanted to open up his line with us in this country. Now, I happened to know more of the facts of the case than the man did who was representing that firm. His representative had made a great number of calls for this line, and he had made them intelligently and persistently. I used to run across him time and again, no matter how often he had been turned down. That firm did not back up the house that was handling their line. To my knowledge they never assisted with the advertising, and never turned in and gave a hand to put their line in the Canadian market. The firm that had been making all these attempts was to be turned down flat and the line handed over to us. I refused. I told that representative that he had been well represented in this field, and that if the business were not forthcoming it was no fault of their representative."

Now, it seems to me that an association of machine tool dealers would be able to bring out all the facts with a case like that, and help all concerned. I do not mean for one minute that any central organization could dictate the policy of any firm. I know we would not stand for that, neither would any other firm that I know of. But apart from that, there are many matters that could be discussed to the mutual advantage of all concerned."

PLAN BRIDGE TO CROSS AT WINDSOR

Scheme Would Involve an Expenditure of $12,000,000—Plans Under Way

Detroit.—Under the leadership of Gustav L. Lindenthal, the eminent Swedish engineer, of New York, a movement is on foot to organize a corporation under the charter of the American and Canadian Governments for the purpose of constructing a $28,000,000 suspension bridge across the Detroit River, connecting Detroit and Windsor. The plans have been so far advanced that the proposition seems assured.

It is proposed to build a bridge supported from towers on either side of the river with double deck suspension, the span to be capable of handling railroad, street car, automobile and pedestrian traffic. There would be one span 110 feet from the water level, which would allow any of the Great Lakes carriers to pass through.

MUST GET RID OF COAL AT SYDNEY

Embargo Against Shipping Brings Up a Big Problem of Employment

Sydney, N.S.—What to do with the surplus coal of Cape Breton is a problem. The embargo on at present forbids coal going to foreign countries. With the closing of the St. Lawrence the large bunker trade which the Dominion Coal Company has enjoyed during the summer will be very greatly reduced. By the curtailment of this business the company will have a still larger surplus from its mines than it has at present.

If the mines of Cape Breton are to be given steady work throughout the winter there are only two ways in which this can be obtained, according to a prominent coal official, one is to remove the present embargo or have the companies obtain a market in Great Britain. At present Britain faces a very grave situation as regards coal supplies, and the heating problem is a very serious one.

There seems to be no reasonable grounds for curtailing the output of the Cape Breton mines, but unless local mines can find an outlet in Britain for the surplus output from their collieries, the companies will have to resort to banking in order to keep the mines working.

Shipping coal from Cape Breton to Great Britain would involve few, if any more, difficulties than shipping to Rotterdam. In spite of this, coal could be landed at a fair marketable price in Britain, freight rates would not be any higher than to Rotterdam and possibly a little lower. In such cases the difference would make up for the little extra time in discharging.



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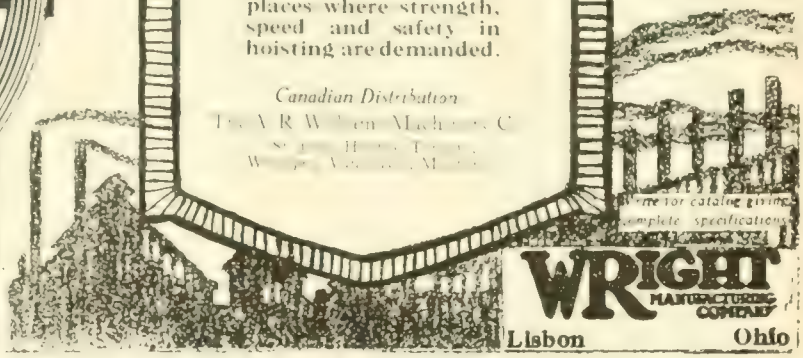
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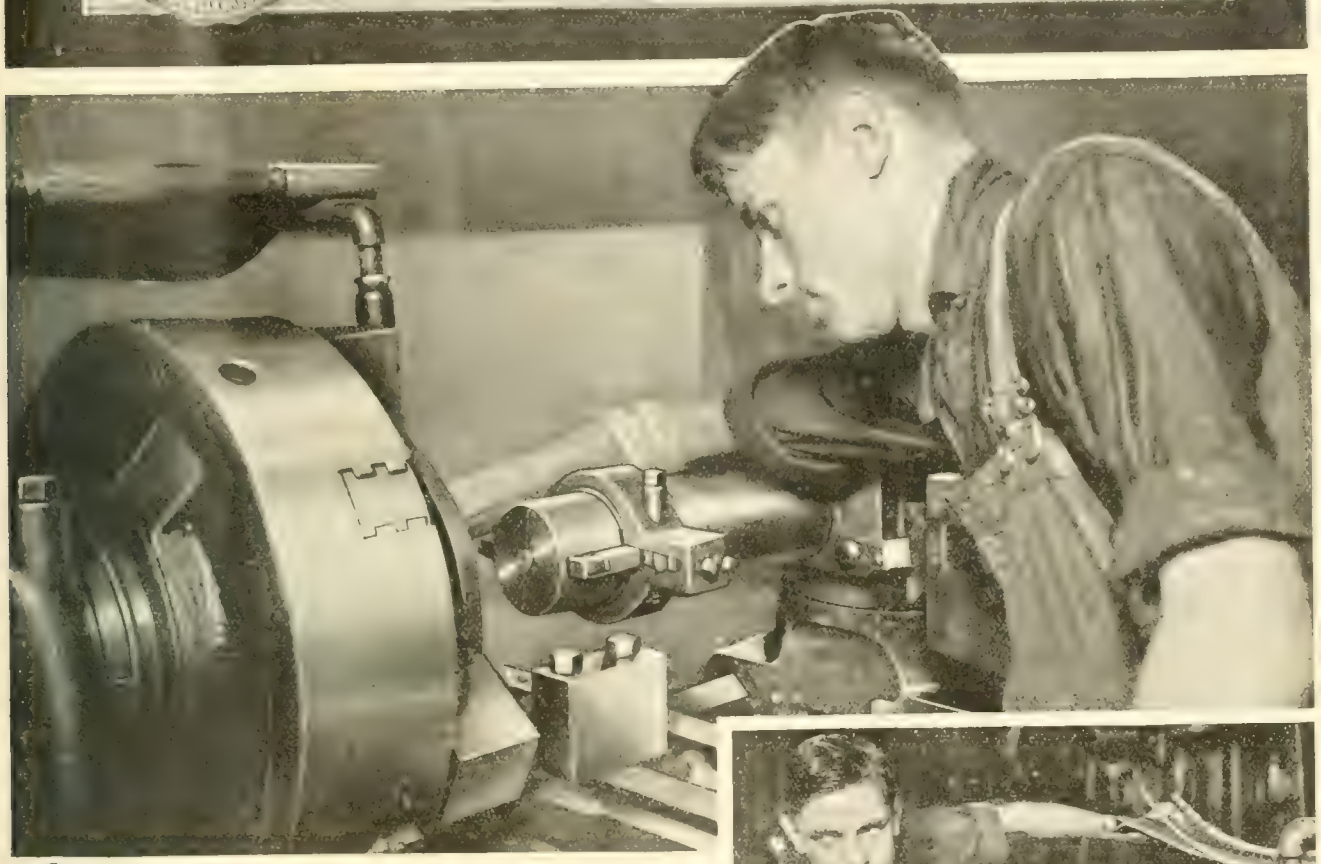
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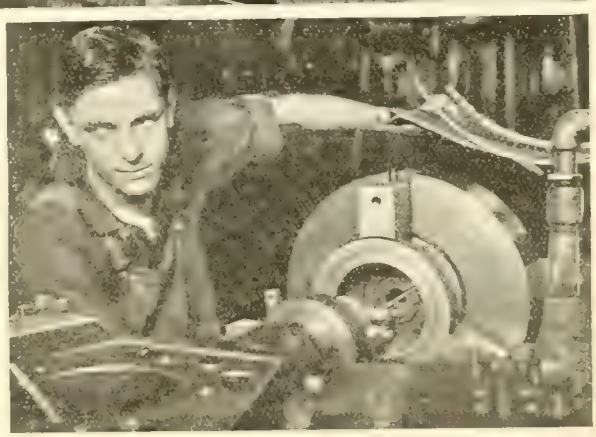
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By Sir Robert Falconer, President of the University of Toronto

CANADA is threatened with another epidemic—cheap teachers! A grave warning, showing the seriousness of the situation, has been made public, through the medium of MACLEAN'S MAGAZINE.

The financial attractions in commerce and trade are proving such a lure to the clever Normal School and University graduates that public schools, high schools and universities throughout the Dominion are being driven to engage inferior teachers—if they can get any at all! One teacher in Ontario is paid the princely sum of $300 per annum.

The article gives the opinions on this vital topic of such men as: Sir Robert Falconer; Principal R. Bruce Taylor, of Queen's; Dean of Arts W. Sherwood Fox, of Western University; A. P. S. Glassco, Secretary of McGill; President MacLean, of the University of Manitoba; President Klinck, of Canada's youngest university—British Columbia; President A. Stanley Mackenzie, of Dalhousie; and many others.

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Other Features of the December Number

"Merrie Gentlemen"—By Arthur Beverley Baxter.
You will think this the best Christmas story since Dickens' "A Christmas Carol."

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A humorous article on some phases of Canadian society.

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An article on the way Yuletide was celebrated in a Red Cross Hospital.
And a dozen other articles and stories all of equal interest.

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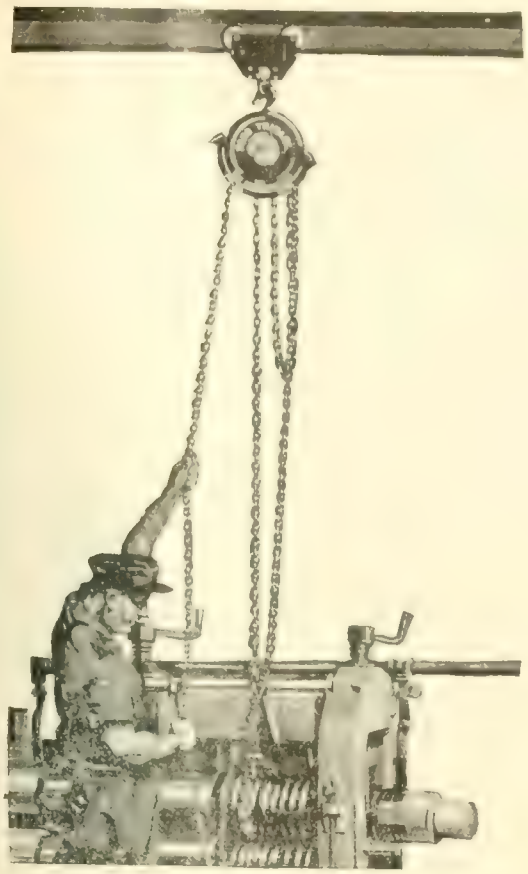
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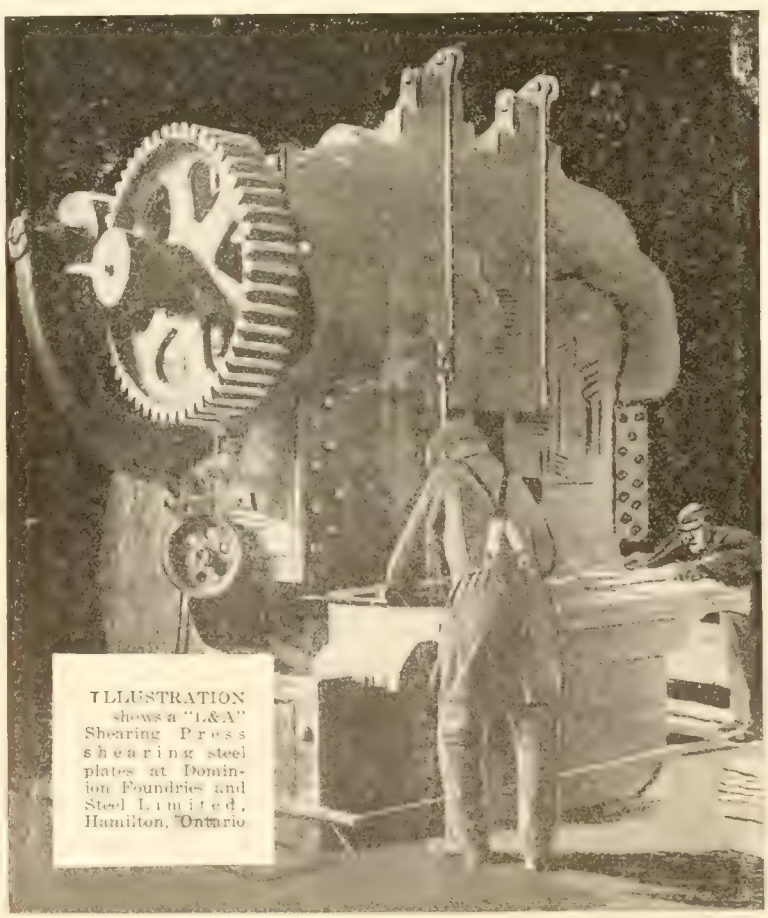


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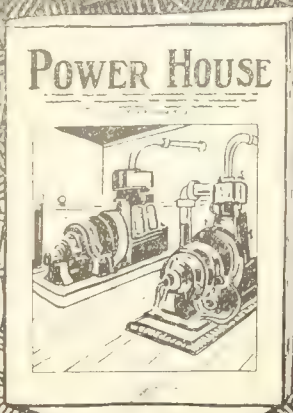
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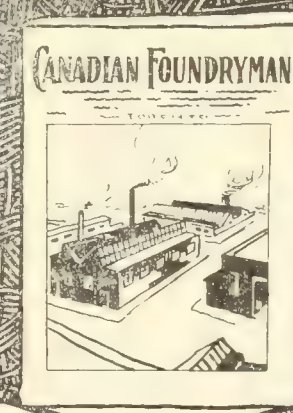
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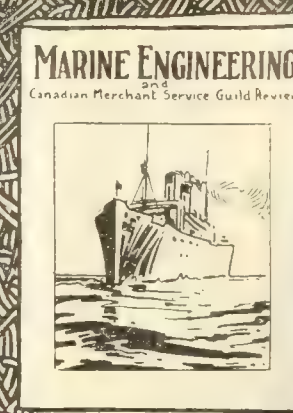
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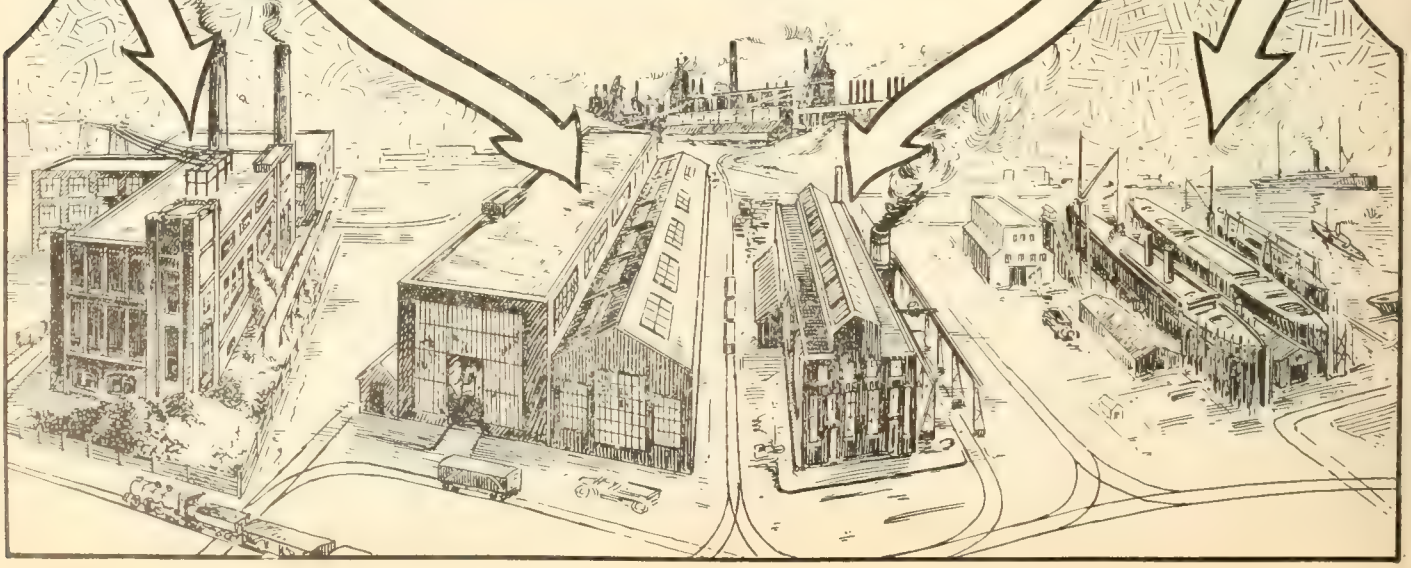
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1—Gas Furnace for Annealing Scrap Brass.
5—26 ft. Rockwell Single Chamber Annealing Furnaces, equipped with Electric Pyrometers and Recording Instruments, Oil and Gas Burners, Air Rams and Pullers.
1—16 ft. Rockwell Single Chamber Annealing Furnace equipped with Electric Pyrometers and Recording Instruments, Oil and Gas Burners, Air Rams and Pullers.
3—Conveyor Type Annealing Furnaces. Could be used for annealing automobile pistons or other similar work.

BLOWERS AND FANS

	Size of Outlet		Displacement per rev.
1—Root Positive Blower	8"	Vertical	3.3 cu. ft.
2—Connersville Positive Blower....	8"	"	3.3 " "
2— " " "	6"	"	1.5 " "
1— " " "	6"	Horizontal	1.5 " "
1— " " "	5"	"	1.5 " "
1—No. 4 Sheldon Blower.....	9"	"	
2—No. 4 " "	9"	Vertical	
1—No. 1 Sturtevant "	10"	Horizontal	
1—Boland Positive Blower	4"	"	
3—Desk Fans.			

MOTORS

10 to 75 H.P., 25 and 60 cycle, 220 Volt., 3-phase.

MISCELLANEOUS

DRILLS

1 3 Spindle Variable Speed Drill. C. G. Allan Co., Barrie, Mass.

SHEARS

1 No. 1 Gray's Sheet Metal Cutter.
1 No. 1 Quickwork Rotary Shear.

HACKSAWS

1 No. 3 Atkins Power Hacksaw.

MILLING MACHINES

1—No. 1 Standard Hand Miller.
11—No. 3 Brown-Boggs Trimming Machines.
1—No. 066 Deming Gear Oil Pump, Belt Drive.
2—Franklin Portable Cranes.
12—Cowan Elevating Trucks.
2—20-lb. Cap. Scales Drams Graduation on Beam.
1—Two-Ton Platform Scale.
1—Five-Ton " "
2—½-Ton " "
2—1,200-lb. " "
1—Tinius Olsen Testing Machine, 10,000 lbs. capacity, hand-operated.
1—No. 1 Brinell Hydraulic Testing Machine.
1—Sauveur-Boylston Photo-Micrographic Instrument.
23—4" Curtis Air Hoists.
2—5" " " "
1—6" " " "
26 I-Beams for Curtis Air Hoists.
1—Boland Special Sand Blast Machine.
1—No. 2X Garvin Vertical Tapping Machine.
1 Whitton Centering Machine.
Dodge Wood Split Pulleys.
Cast Iron Split Pulleys.
Shafting and Hangers.
1—Model "M" Richardson Force Feed Oil Pump.
3—No. 310 Simplex Lifting Jacks.
4—2½" x 18" Screw Jacks.
1—2¼" x 16" " "
3—1¼" x 4" " "
1—No. 873 Toledo Trimming Machine.
Bristol & Brown Indicating Pyromters.
" " Recording "
3—Shore Scleroscopes.
1—C. E. Wright Metal Cutting Handsaw, 30" Wheels.
1—No. 35 Demagnetizer Style, 115 D.C., Amps. 1.5, Volts 115. Made by D. & W. Fuse Co., Providence, R.I.
5—Heads Suitable for Polishing Brushes, 1¾" Hole in chuck, 1" spindle.
1—Bench Tapping Machine, takes up to ⅜" tap. Burke Machine Company, Conneaut, Ohio.
1—Carboy of Cement Hardening, 5 Gals.
1—Thor 1—1/16" x 4" serial D.R.H. Air Hammer.
1—Ingersoll Rand, size 1 S, symbol 1 SM Air Hammer.
1—Ford Car Starter.
2—Automatic Receivers for Boiler House Feed Pumps.
1—Tank, 30" dia. x 48" long, suitable for Compressed Air.
1—Tank, 24" dia. x 60" " " " " "
1—Tank, 36" dia. x 72" " " " " "
1—Open Galv. Iron Tank, 5 ft. high x 3 ft. dia. with 1" faucet.
4—¼" Thick Iron Open Tanks, 4 ft. long, 2 ft. wide x 1 ft. 8 in. deep with 2 in. drain.
1—Motor-driven addressograph machine with stencil cutting machine and full equipment of special attachments.
2—Adding Machines (Listing)

CANADIAN CARTRIDGE COMPANY, LIMITED

HAMILTON, CANADA

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WILTON

Master Gage Blocks

Each block is guaranteed to be accurate to within ten millionths of an inch for each inch in length and when used with the accessories constitute a complete gauging system.

SET C

consists of 35 blocks which wring together, giving all dimensions from 3/10″ to over 12″ in steps of 1/10,000″.

Price in Walnut Case.....$175.00

The accessories include three Holders, Vee Blocks, Measuring Plugs, Scribers, etc.

Price in Walnut Case.....$75.00

SET E

consists of five Round blocks, giving all dimensions by sixteenths from 1/16″ to 1 5/16″ (accurate to within fifteen millionths of an inch).

Price in Black Nickel Case.....$8.50

All prices f.o.b. Boston, Mass.

IMMEDIATE DELIVERIES. **WRITE FOR CATALOGUE.**

WILTON TOOL & MFG. CO.

84 LINDEN PARK ST. BOSTON, MASS.

Agents Wanted



SET C, Price $175.00

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DOMINION CHUCKS



Especially Adapted for Severe and Heavy Duty Work

BODY—The body is of heavy cross section and so designed to give broad and deep bearings for the jaws.

JAWS The jaws are drop forgings, heat treated. The jaw is so designed that the threaded portion makes 180° contact with the screw.

SCREWS—The screws are large in diameter, broached at both ends and are reversible.

Dominion Chucks can be furnished in crucible or cast iron bodies.

Designers and Manufacturers of

Rubber Manufacturing Machinery.
Rolling Mills Equipment.
Marine Line and Propeller Shafting, Stern Tubes, etc.
Cut Gears—Worm, Spur, Helical and Bevel.
Heat Treated Tool Steel Gears and Pinions.
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Dominion Steel Products Co., Limited

Engineers and Manufacturers

Brantford, Ontario

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A sturdy, efficient and economical Electric Furnace

OUR CLIENTS INCLUDE:

Five (5) U.S. Navy Yards
British Govt. (2 furnaces)
Ford Motor Co. (2 furnaces)
Halcomb Steel Co. (2 furnaces)
American Radiator Co. (3 furnaces)
Davidson Tool Co.
Puegeot Freres
Daimler Motor Co.
Leyland Motor Co.
Imperial Japanese Mint
Kayser Ellison Co. (1 15 20 ton furnace)
Sociedad Espanola Construction Naval, Madrid, Spain
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Vancouver Eng. Works, Limited, Vancouver, B.C.
43 other well-know firms.



Three ton furnace in operation, Philadelphia Navy Yard

"Greaves Etchells" System

ELECTRIC FURNACE CONSTRUCTION CO.

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"WACO"

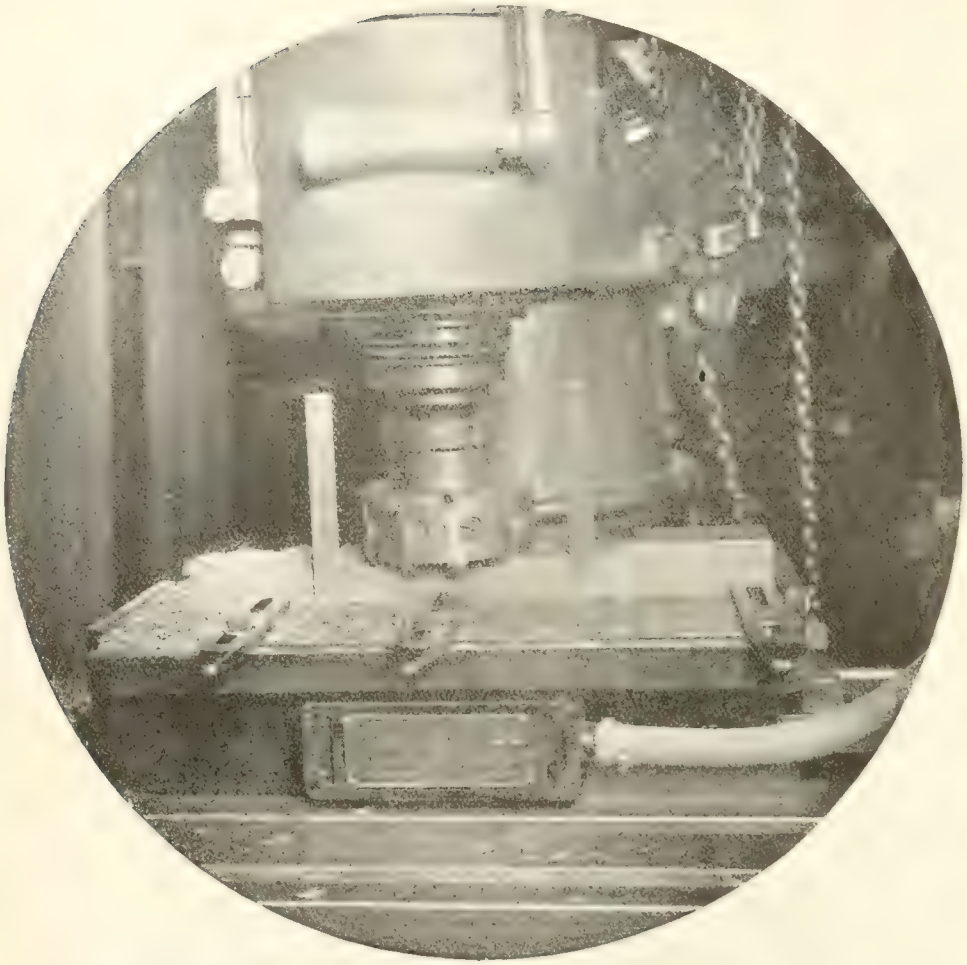
THE HIGH SPEED STEEL

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39 Richmond Street East TORONTO, ONT.

SOLE CANADIAN AGENTS FOR
WM. ATKINS & CO., LIMITED
SHEFFIELD - - ENGLAND

ALL SIZES
IN STOCK





Holding a 5/16 x 2 in. Cut in Cast Iron on a Simmons Magnetic Chuck

Here is an example of the "grip" of a Simmons Chuck used on a No. 5 Brown & Sharpe Vertical Milling Machine.

On a piece of cast iron 16 in. x 2 in. x 1½ in. held by an 8 in. x 18 in. chuck, a cut 5-16 in. deep was made across the entire piece. The feed was 12½ in. per minute from the beginning of cut; the cutter was a 5 in. diameter inserted tooth face mill, running at a speed of 100 R.P.M. for the entire cut. Current used by the Chuck 0.4 amp. at 110 volt. *The strongest "grip," with the least current* —and no leakage of magnetism into frame of chuck or machine. It is powerful and yet it conserves electricity.

Bulletin 107E describes Simmons Magnetic Chucks

TAFT-PEIRCE
Woonsocket, R.I., U.S.A.

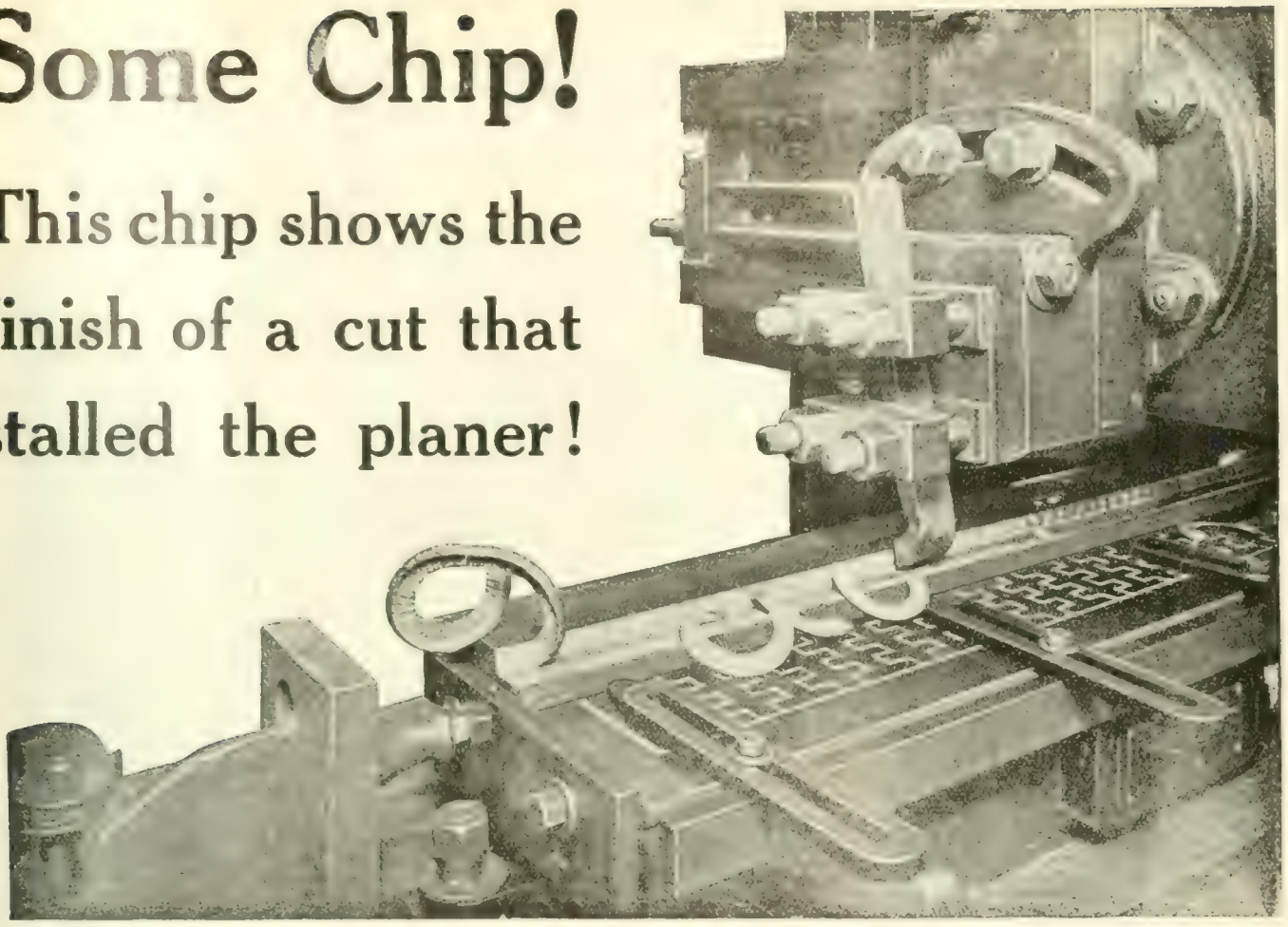
New York: Woolworth Building Detroit: Majestic Building

Williams & Wilson, Ltd., Montreal and Quebec

2070

Some Chip!

This chip shows the finish of a cut that stalled the planer!



The cut was started at the far end of the piece and the work never budged. Some of the factors that contribute to the holding power and reliability of the SIMMONS UNIT POLE MAGNETIC CHUCK are:

1—Effective utilization of the space on the face of the chuck;
2—Use of unit magnetic pole pieces of forged iron placed adjacent to each other with no neutral poles or neutral spaces between them;
3—Gaps between poles uniform throughout because adjacent edges are machined to definite dimensions;
4—Complete magnetic circuit insulated from the body of the chuck—a patented construction;
5—Machine wound coils assure uniform quality and equal ampere-turns in all;
6—Interlocking pole pieces offer transverse as well as longitudinal resistance to the work;
7—Watertight construction.

The Simmons Unit-pole magnetic chuck works where others fail, because it is designed in accordance with the principles of correct magnetic practice and gets the maximum pulling power that can be obtained in a given space. Ask for bulletin 107-E.

Details of Tests

The test here shown was made on a 30-inch Gray planer equipped with a 31 x 10¼-inch T-slot Simmons Unit-Pole Magnetic Chuck. The cut was taken on a cold rolled steel bar 31 inches long, 4 inches wide and ¾-inch thick. The chip was ⅝-inch deep and 3-16-inch thick. It stalled the machine.

TAFT-PEIRCE

Woonsocket, R.I., U.S.A.

New York Office: Woolworth Building **Detroit Office: Majestic Building**

Williams & Wilson, Ltd., Montreal and Quebec

2078



Planing Mill Fan



No. 2 Vacuum Cleaner

Sturtevant (TRADE MARK)

SYSTEMS



Autoforce Ventilator



Steam Turbine



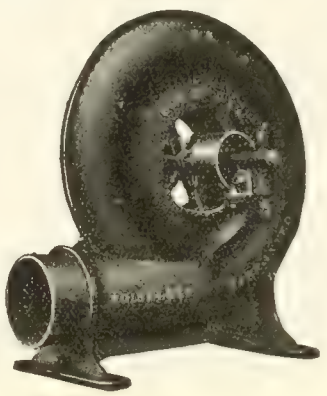
Electric Propeller Fan

Sturtevant (TRADE MARK)

STEEL PRESSURE BLOWERS



Medium Pressure Blower





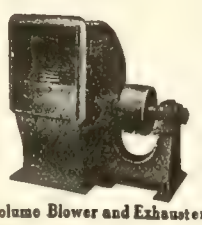
Low Pressure Blower



High Pressure Blower

For All Purposes

THO designed originally for supplying air to cupolas and forges Sturtevant steel pressure blowers are now used for all purposes where pressures up to 16 ounces to the square inch are to be maintained; and where air is to be forced for long distances. Regularly built with horizontal discharge but can be readily made for down blast or up blast. Built in all sizes and may be belt, motor, engine, or turbine driven. Operating and upkeep cost is remarkably low as proven by actual performance in many long term (30 years and more) installations. Design and construction are typically Sturtevant—supreme! Blast wheel is made of refined steel and galvanized to prevent rust. Wheels are accurately balanced and run smoothly when driven at high speed. Bearings are each cast in one piece and are lined with highly durable non-heating white metal. Write for catalogue.



Volume Blower and Exhauster



Gasolene Generating Set



Turbo-Blower

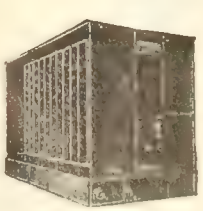


Direct Current Motor

B. F. STURTEVANT COMPANY of Canada, Ltd.

Factory and Main Office
Galt, Ontario

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Type H Air Washer



Fuel Economizer

Sturtevant (TRADE MARK)

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Electric and Hand Operated Cranes and Hoists, Chain Blocks, Jib Cranes, Elevating Trucks, Storage Battery Trucks

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CLINTON CEMENT

Did You Ever See Two Postage Stamps Stuck Back to Back?

Well, that's the way two bricks stick together when our cement is used.

The greatest loss in your furnace efficiency occurs as the result of leakage, cold air pouring in and interfering with proper combustion.

We Have Got This Licked!

Fireclay dries up and sifts out from between the bricks like powder.

But our cement sets and makes a surface like glass yet allowing for expansion and contraction. It sets hot or cold and stands a heat up to 3,000 degrees Fahrenheit.

This cement makes a joint that is stronger than the bricks themselves, and that is itself the strongest part of the whole furnace.

A five-pound tin of **Clinton Super-Heat Cement** will be sent to you free and all charges prepaid, if you write the

Standard Machinery & Supplies Limited

261 Notre Dame St. West **Montreal**

It's Interesting

WHEN a large Hydro-Electric Plant installs a 5000 H.P. Silent Chain Drive.

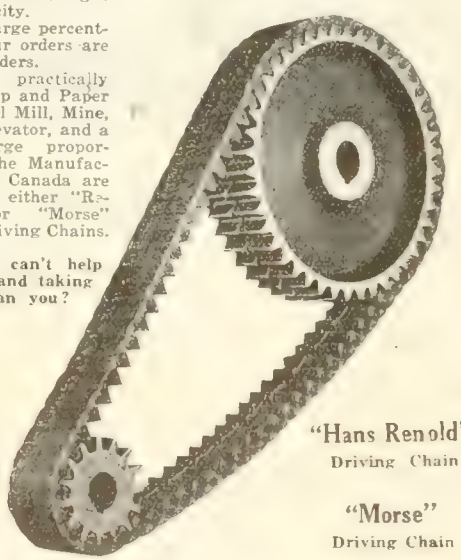
WHEN one of the largest Canadian Manufacturing Plants install over 27 Silent Chain Drives totalling over 4000 H.P.

WHEN a large Candian city installs a 500 H.P. Silent Chain for driving Generators to provide light for the city.

WHEN a large percentage of our orders are repeat orders.

WHEN practically every Pulp and Paper Mill, Steel Mill, Mine, Grain Elevator, and a very large proportion of the Manufacturers in Canada are Users of either "Renold" or "Morse" Silent Driving Chains.

Well, you can't help sitting up and taking notice. Can you?



"Hans Renold" Driving Chain

"Morse" Driving Chain

Sole Canadian Agents:

JONES & GLASSCO

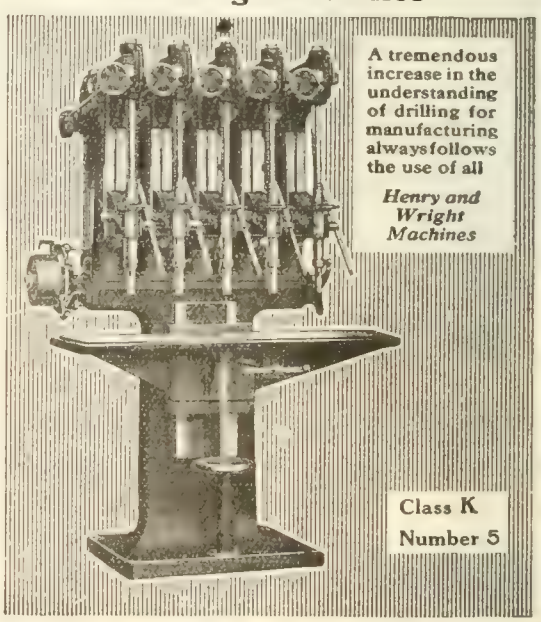
Engineers. (Reg'd.)

MONTREAL St. Nicholas Building.

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HENRY & WRIGHT

Drilling Machines



The Henry & Wright Mfg. Co.

Hartford, Conn.

Canadian Fairbanks-Morse Co., Montreal, Toronto, Winnipeg; A. R. Williams Machinery Co., Toronto, St. John, N.B.; H. W. Petrie, Ltd., Toronto; Williams & Wilson, Montreal; Rudel-Belnap Machinery Co., Montreal; Canada Machinery Corp., Galt, Ont.; Geo. F. Foss Machinery & Supply Co., Montreal; General Supply Co., Montreal.

The foreman says

"I suppose it's because I used them myself when I was at the bench, but it does seem as though the best men in the shop have a preference for Starrett Tools.

"Of course, most of them sort of got into the habit of relying on Starrett for fine work when they were apprentices and journeymen.

"Speaking of apprentices — that little red book there, 'The Starrett Book for Machinists' Apprentices,' has saved me more time and helped more young fellows to learn how to do things right than anything else in the shop.

"When a young lad asks me how to do this or that, I usually tell him or show him, and then ask him if he has one of those books. I've noticed that as soon as he gets one of them he doesn't have half so many questions to ask.

"Starrett gets out another book, 'The Machinists' Data Book,' that's just about as big a help to the experienced machinist. It's got all the tables and formulas and so on that he ever needs, and it isn't cluttered up with a lot of engineers' stuff that he doesn't use.

"Yes, I bought one of each of the books down at the hardware store, as soon as they came out. They cost me seventy-five cents each, but they're worth it."



Starrett Tools



The L. S. STARRETT COMPANY

THE WORLD'S GREATEST TOOLMAKERS

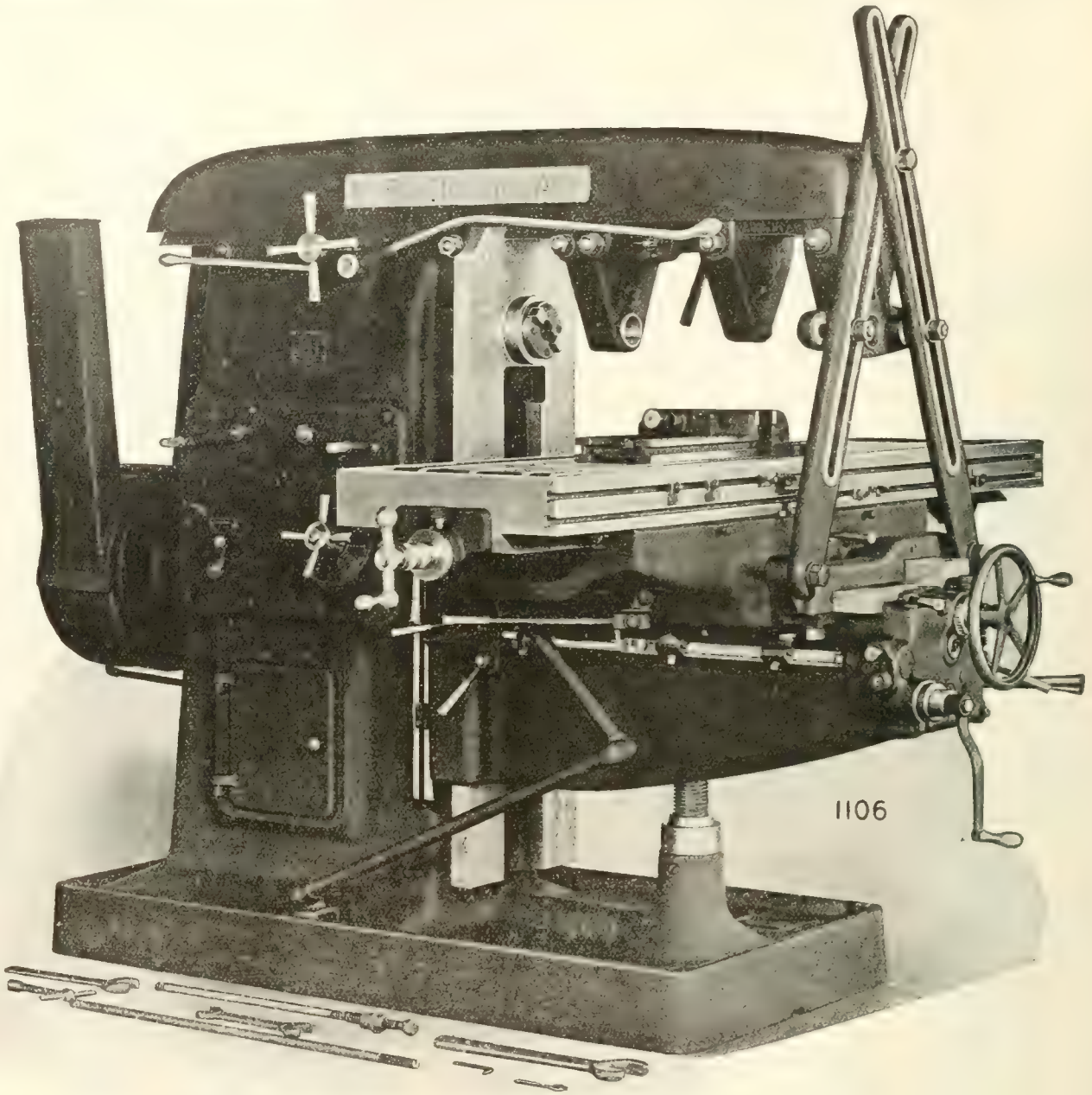
Manufacturers of Hack Saws Unexcelled

ATHOL, MASS.

Machinists the world over have put their faith in the accuracy of Starrett Tools for thirty-nine years. Write for illustrated Catalog No. 21 "3"

42-989

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Nos. 4 and 5 Cincinnati
PLAIN HIGH POWER MILLERS

Intermittent Feed, with power quick traverse Rectangular Overarm. Square Gibbed Bearings, Narrow Guides. Feed changes at front of machine, by one lever, while running.

These and twelve other equally productive features are described in an important new catalog devoted to the new Nos. 4 and 5 Plain, Universal and Vertical Cincinnati Millers.

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CINCINNATI, OHIO

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C. G. E.
Fractional H.P. Motors

Every manufacturer who markets a motor-driven article should take into consideration that if the motor fails to give satisfaction, the whole machine will be condemned.

It is therefore obvious that the utmost care must be exercised in choosing the type of motor that will give maximum satisfaction with minimum attention, relative to the particular requirements of your product.

The C.G.E. Fractional H.P. Motor is a power unit that has stood the test of time. It is giving universal satisfaction in scores of different types of motor-driven appliances—from the Vacuum Cleaner and Washing Machine for the housewife, the Meat Cutter and Coffee Grinder for the butcher and grocer, to the Adding Machine and small Printing Press for the office.

Let us assist you in selecting or building the right motor under one h.p. to operate the machine you are now or contemplate making.

Write our nearest sales branch for full particulars.

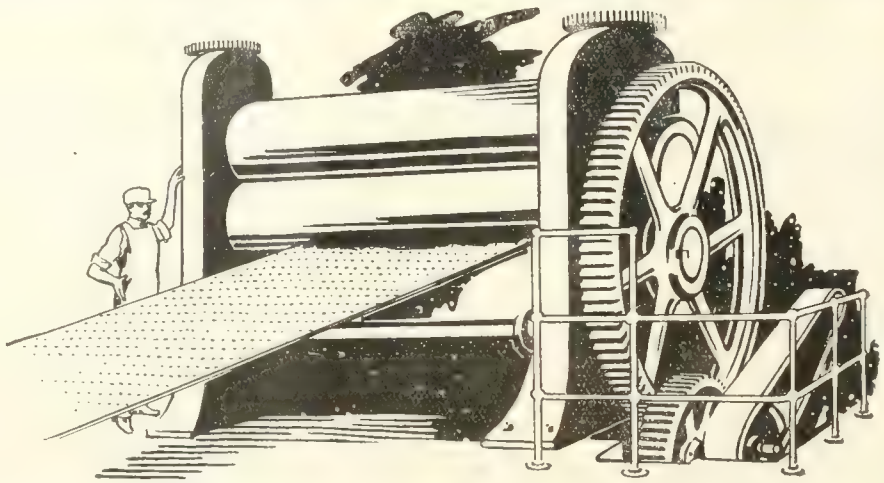
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Friction Surfacing Cuts Power Bills

Here is a statement that you can prove to your satisfaction and profit.

Take the meanest drives in your plant—the ones you know are wasting power in slippage on pulleys — ask our belting engineers to specify the correct size of

Dominion Friction Surface Belting

Keep a careful record of those belts for one or two months, or even a year, and compare it with the previous performance of those same drives—then compare *your* power bills for the two periods.

Dominion Friction Surface Belting will prove, in service, every claim we make for it, because the rubber with which it is saturated is a special friction compound that prevents practically all slippage and pays for itself in the power saved.

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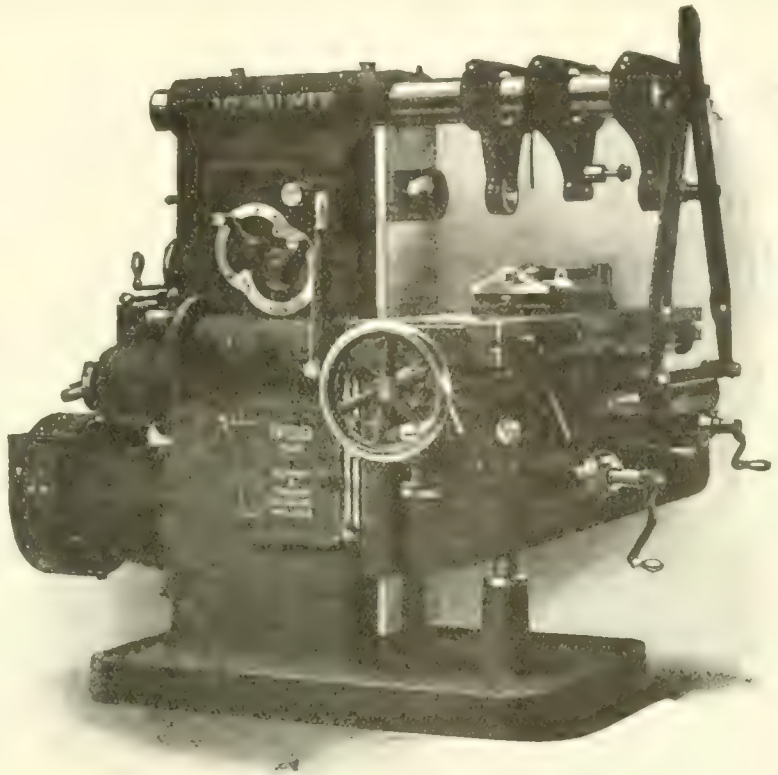
Phone or wire our nearest Service Branch.

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Makers of Dominion Hose, Packing and Industrial Rubber Goods and Dominion Tires, the GOOD Tires for every purpose.

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MILWAUKEE MILLING MACHINES

Double Overarm maintains alignment.

It is impossible for the operator to place the arbor supports on the arbor and double overarm in any other way than in line. Arbor cannot be pounded out of line when using large, coarse pitch cutters on rough, heavy work.

Other Distinctive Milwaukee Features:

Solid top knee—hardened steel gearing and shafts in the column and feed box—automatic flooded lubrication — one and one-half gallons of oil per minute pouring over all gears and bearings in the column and feed box, insuring lubrication at all times—flanged spindle with hardened steel collar for driving arbors—constant speed drive, reverse being self-contained.

Send for our No. 21 Catalogue. Illustrating and describing Milwaukee Milling Machines and accessories in detail

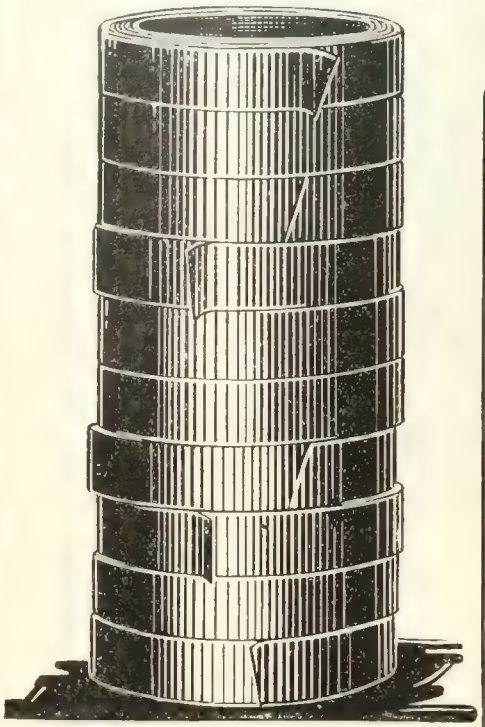
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MILWAUKEE, WIS. U.S.A.

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SPRINGS, WIRE & STEEL — EST — "BARNES-MADE" PRODUCTS — 1857 — SCREW MACHINE PRODUCTS



"Barnes-made for every trade"

The Steel

The rolling of Spring Steel, suitable for manufacture into "Barnes-made" springs, is carried on in our own factories.

Rolling machinery of the most approved type is used.

The skill and care exerted in perfecting the metal during these first stages count in the lasting life of Barnes-made springs.

ESTABLISHED 1857

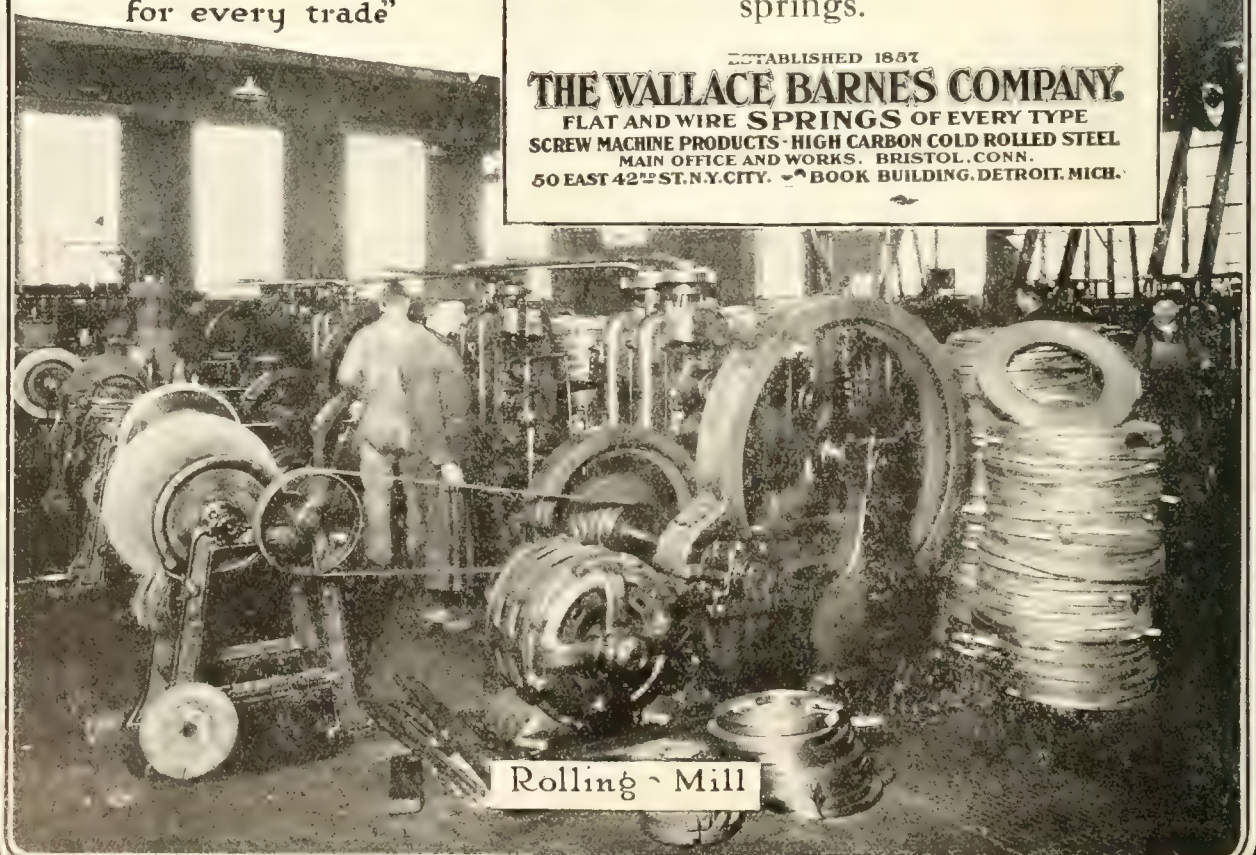
THE WALLACE BARNES COMPANY.

FLAT AND WIRE SPRINGS OF EVERY TYPE

SCREW MACHINE PRODUCTS - HIGH CARBON COLD ROLLED STEEL

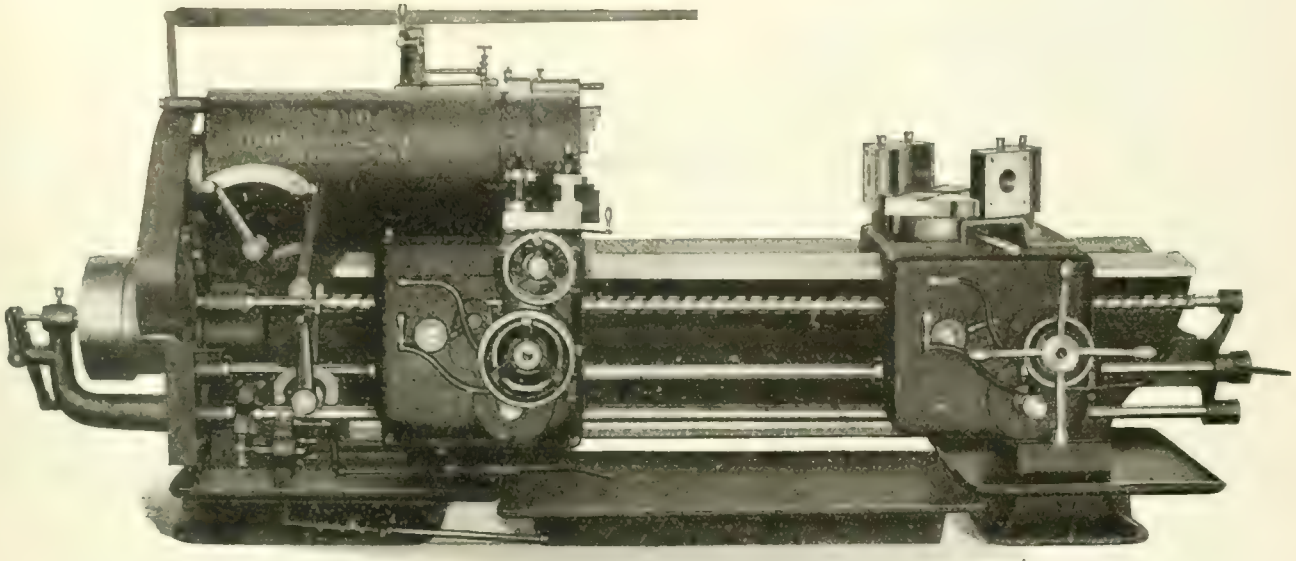
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Rolling - Mill

STEINLE



Still another reason why the Steinle 24" Full Swing Side Carriage Turret Lathe is ahead of all others in the economical and accurate production of many classes of work.

THE COMBINATION TURRET

In designing this turret the following points were taken into careful consideration:

The proper manner of supporting different kinds of tool equipment required on a machine of this character.

Avoidance of excessive tool overhang.

Ability to secure the full benefit of the side carriage in relation to the absence of turret tool overhang.

As regularly furnished, the combination turret is hexagon in form, 21" in diameter, and has two open sides and four bored faces. The open sides permit of universal facing heads or similar tool equipment being firmly secured to the bed of the turret and provide for suitable adjustment of tools to the work with a minimum overhang. The bored faces carry drills, boring bars, reamers, die heads, taps, etc.

The combination turret has power traverse and quick change reversible longitudinal feed controlled from the apron.

The bearing on the saddle is the full diameter of the turret. The locking pin is located in front, the greatest possible distance from king pin. One motion of the binding lever releases the pin and turret, or binds same.

The design of the combination turret secures the full advantage of the side carriage feature.

STEINLE TURRET MACHINE CO.

MADISON - - WISCONSIN, U.S.A.

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Speed Up Your Metal Cutting

Drive your sawing machines to the limit.
They'll stand it if you fit them with

Hunter "Duplex" Blades



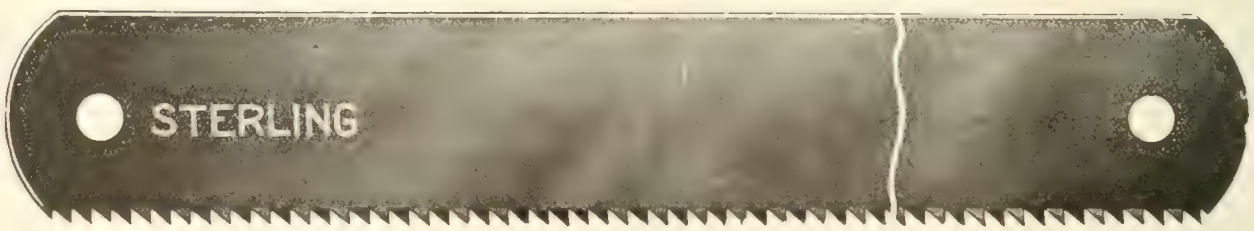
The design of this inserted tooth saw gives the greatest possible number of teeth, with the result that material can be cut with greater speed, as the rigid construction withstands heavier feeds.

For fast cutting and long life specify Hunter "Duplex."

Hot Saws, Friction Discs, Solid Blades made from Vanadium, Tungsten and Chrome Alloy Steels. Saw Sharpening Machines, Inserted Tooth Grinders. Hardened Steel Specialties, etc. Write for prices.

Hunter Saw & Machine Co. Pittsburgh, Pa.

"STERLING"
HACK SAW BLADES



A brand once adopted, difficult to replace.

REASONS—High quality of material used, mechanical construction, and special heat treatment.

RESULTS—Economy, which means satisfied customers.

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Photographic Copying
The PHOTOSTAT

(Trade Mark Registered)

"Orders are now delivered three or four days earlier to our customers by making photographic copies of sketches and drawings which are the same in every detail instead of having our draftsmen reproduce the original.

"Practically all orders were previously held up three or four days by our drafting department while copies of the intricate drawings of ordered tools were being made. Now with the Photostat, only 15 or 20 minutes are required to make the three copies, exact duplicates of the original, which the factory needs to turn out the order. By eliminating this needless delay we are able to provide better service for our customers, and attract new prospects because of prompt deliveries."



This cut shows a PHOTOSTAT on which a large drawing has just been copied in less than a minute.

Never Makes a Mistake

It is simple, practical, easy to handle. Requires no expert knowledge. The machine is loaded with a roll of sensitized paper especially manufactured for the purpose.

The original subject is photographed directly upon this paper producing a facsimile copy which is immediately cut off, developed and fixed right in the PHOTOSTAT itself.

The focusing, exposing and developing are all controlled by simple mechanical devices and no glass plate, film or other intermediate negative has to be made.

After fixing, the copy is removed to a tank of running water and rapidly washed free from chemicals. It is then dried and is ready for use. As many copies as desired may be run off in this manner.

By a simple adjustment of the mechanical focusing device the copy may be made at actual size, reduced, or enlarged, within the size limitations of the machine.

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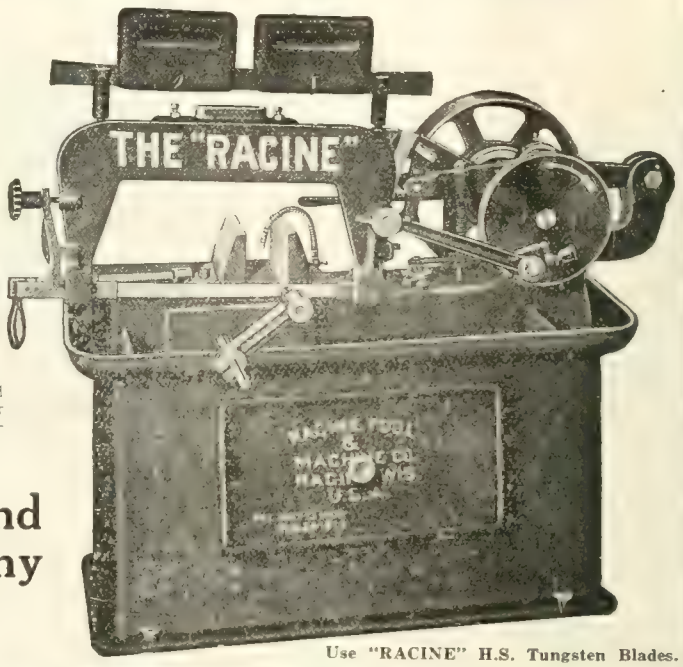
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Reduce Your
Metal Cutting Costs
with
THE
"RACINE"
Speediest of All
Metal Cutters

DO you know that the "RACINE" High Speed Cutting Machine has a patented feature that lifts it above any other metal cutter made? This is the patented Automatic Lifting Device, which automatically lifts the blade on the return stroke, preventing all dragging and strain on the non-cutting stroke. **The result is speedier cutting with less power and a big saving in blades.**

Instal the "RACINE" to Offset High Cost of Production!



THE "RACINE" machine and "RACINE" H.S. Tungsten Power Blades make an efficient and economical combination—use both.

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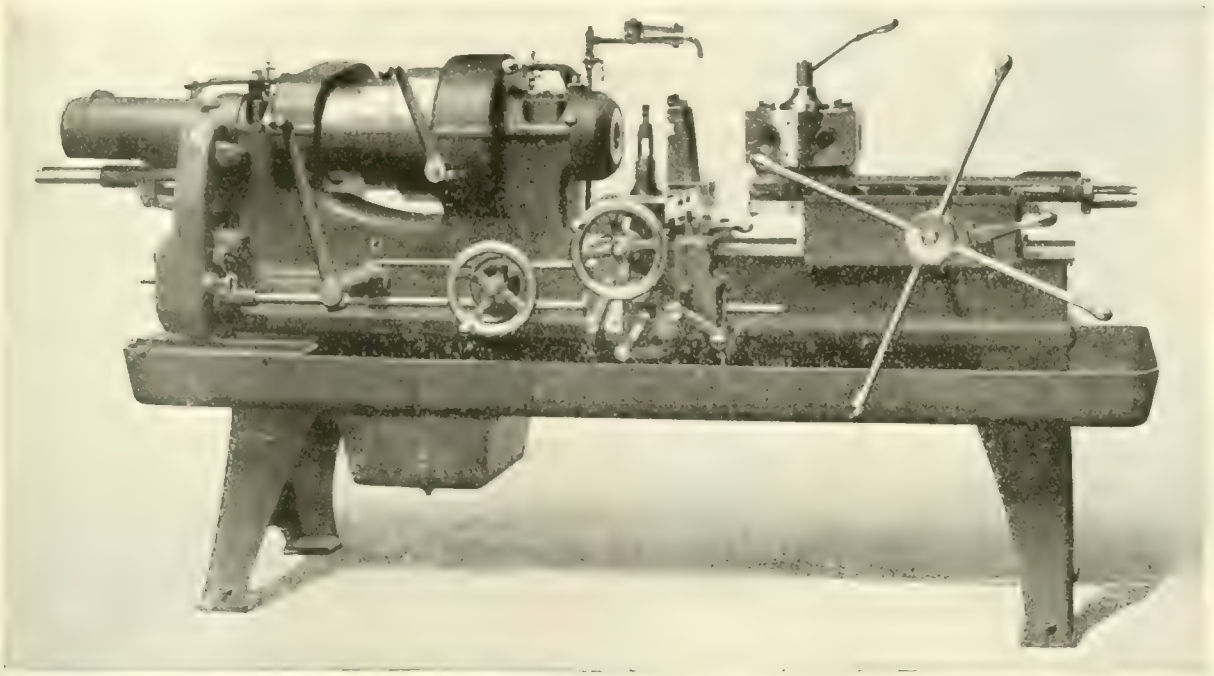
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Use "RACINE" H.S. Tungsten Blades.

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UNEQUALED IN QUALITY ANY SIZE OR LENGTH
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is more powerful yet easier to operate



THIS NEW No. 6 TURRET LATHE is welcomed by manufacturers who finish gear blanks, forgings and tough alloy steel parts. As powerful as the large and more expensive machines used on this work, the No. 6 increases production and is easier to operate.

Capacity:
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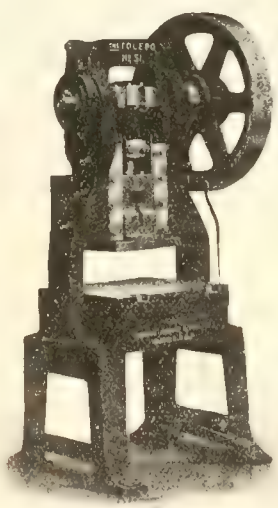
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Adapted to such a wide range of work they can be kept busy every working hour.

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Also adaptable to armature disc blanking and a wide range of work in the thinner gauges of metal.

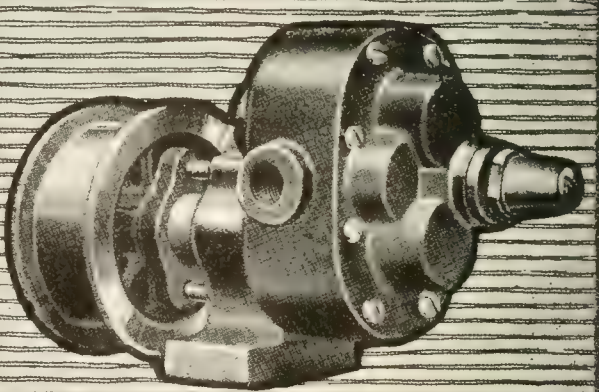
The Toledo Machine & Tool Co.

Toledo, Ohio

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Trahern Pumps specialize in delivering a continuous, forceful non-pulsating stream of oil, against 800 lbs. pressure if necessary. If installed properly will not loose prime, operate at low speed, long life.

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RICKERT - SHAFER TAPPERS

The *smooth drive* reduces the strain on the taps—they wear longer—and there are fewer delays from taps breaking in the work.

R-S Tappers ensure faster tapping and quicker assembling.

Friction drive, absorbing all the shock, allows a chuck speed of 140 r.p.m. on 5/8-in. work—50 per cent. faster than the usual tapping speed for that size. Uses but 1 h.p.

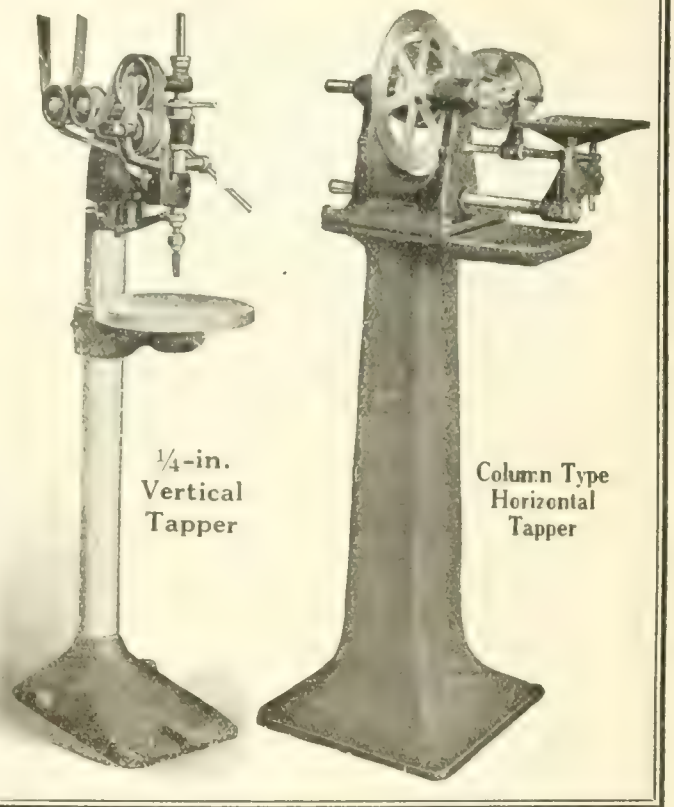
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Save Tap Breakage



¼-in. Vertical Tapper

Column Type Horizontal Tapper

SPECIAL TOOLS

Automatic Machinery

for all purposes

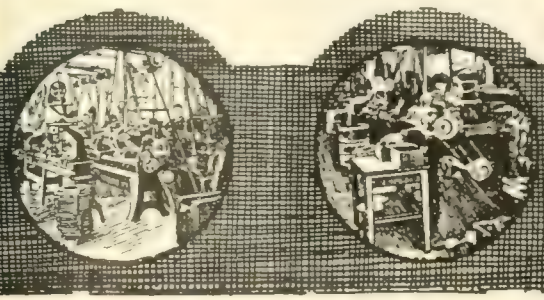
Punch Press Work

Screw Machine Products

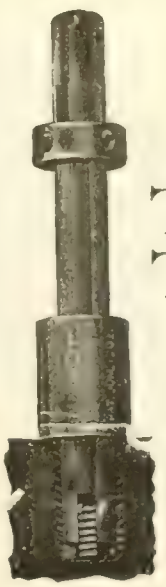
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Steel Fingers Slip into the Flutes



Grip the broken tap and back it out before you've had time to count three times sixty.

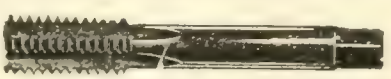
The Walton Tap Extractor

removes broken taps buried below the surface of the work without trouble or loss of time. It removes any broken tap without injuring the threads. It saves the casting or forging. Pays for itself over and over—often on the very first job.

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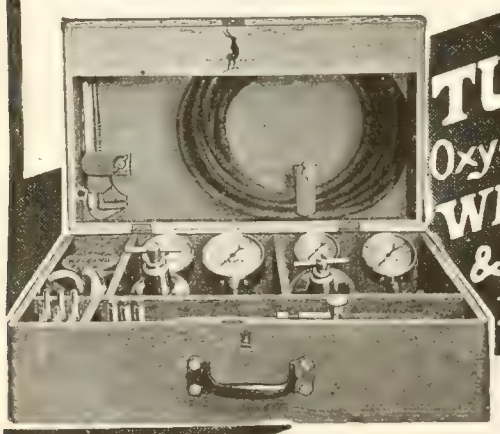
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Supplied in 100 or 200 Cubic Feet Cylinders.

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These outfits will soon pay their cost in machine parts or tools reclaimed. The sectional extensions of the torch enable the operator to adjust it to any desired length or angle. The location of valves is such that the flame is controlled by one hand, leaving the other hand free for the work at all times.

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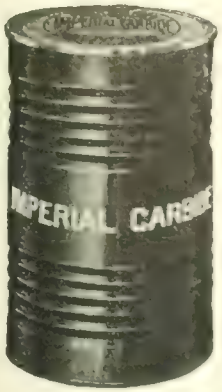
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We also handle Pure Acetylene.

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HIGHEST GAS YIELD IMPERIAL CARBIDE MADE IN CANADA

It insures **effectiveness** and **economy** by **invariably** producing acetylene gas of **unusual purity.**

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Saves Oxygen Eliminates Flash-Back Better Welding

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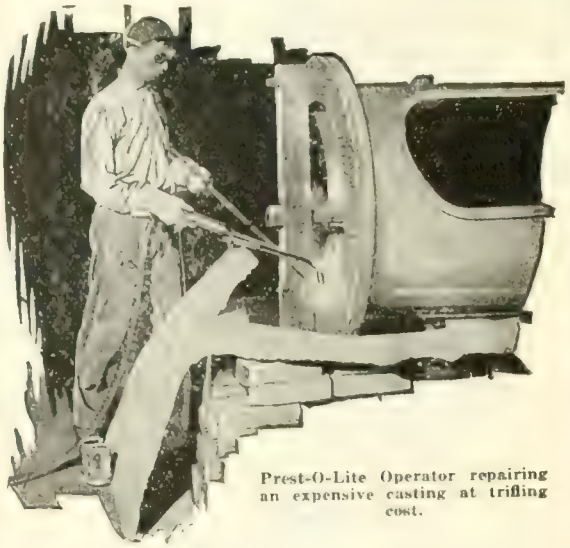
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Oxy-Acetylene Welding and Cutting



Prest-O-Lite Operator repairing an expensive casting at trifling cost.

Prest-O-Lite Welding Saves Replacements

The Prest-O-Lite Process of Oxy-Acetylene welding is daily opening up new possibilities for economy and efficiency in the factories, mills, railroads, mines and machine shops of Canada.

For repair work, as well as for manufacturing, it is saving time and money in thousands of plants. Valuable time is saved through one Prest-O-Lite repair. Important machinery, machine parts and tools are saved from the scrap pile, and expensive replacements are frequently avoided.

Prest-O-Lite PROCESS

employs both gases (acetylene and oxygen) in portable cylinders. Prest-O-Lite Dissolved Acetylene is backed by Prest-O-Lite Service, which insures prompt exchange of full cylinders for empty ones; provides dry, purified gas, insuring better welds, quicker work and lower operating cost.

Apparatus consists of an equal pressure blow pipe, automatic regulators and gauges, and all necessary equipment. Adaptable for oxy-acetylene cutting by the addition of special cutting blow pipe.

Thorough instructions are furnished free to every user of Prest-O-Lite Dissolved Acetylene. Any average workman who understands metals can learn the welding process quickly and easily.

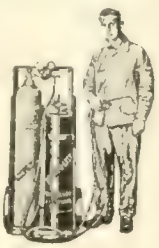
We will gladly send illustrated literature and interesting data showing actual instances of savings made by others. It may suggest valuable ideas to you. Write for it.

Address Department C-107.

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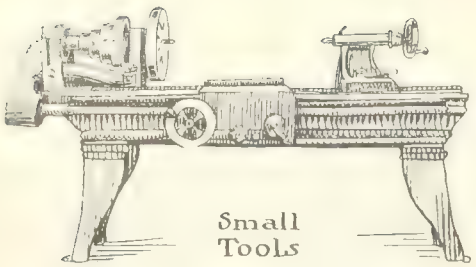
PREST-O-LITE BUILDING
Corner Elm St. and Centre Ave.
TORONTO

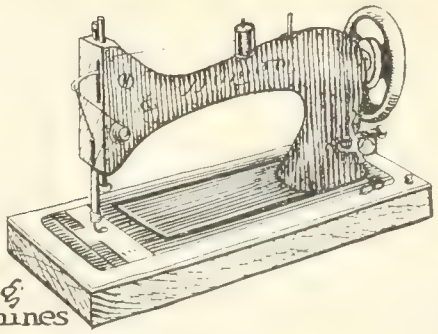
Plants at: Toronto, Ont., Merritton, Ont. Shawinigan Falls, P.Q., St. Boniface, Man.

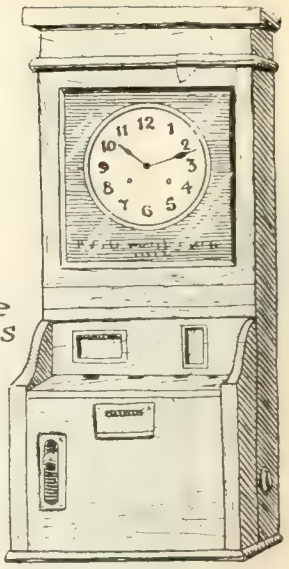


World's Largest Makers of Dissolved Acetylene

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Time Clocks

It's Made for YOUR Work

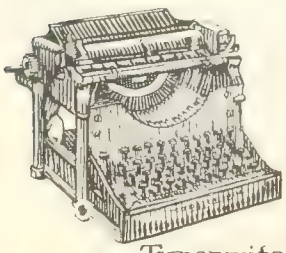
Leading manufacturers of scores of different kinds of light machines are of the opinion that the Bilton Gear Miller was designed for their individual needs.

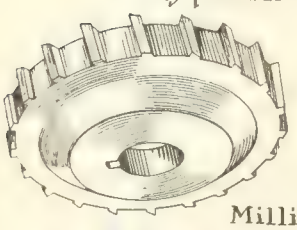
It so speedily and accurately produces spur and bevel gears and worms, and the countless small irregular parts that enter in the makeup of your product, that you cannot be blamed for thinking it was built for your special use.

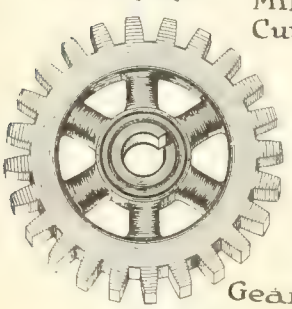
It is a valuable addition to your tool room for producing small milling cutters, reamers, etc.

If production increase interests you, our circulars will make pleasant reading; better put in that request to-day.

Ask for copy of Catalog No. 30

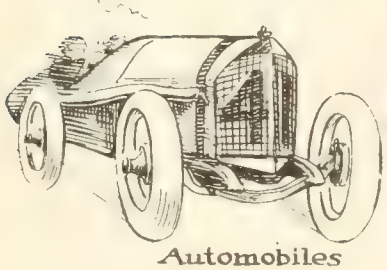

Typewriters

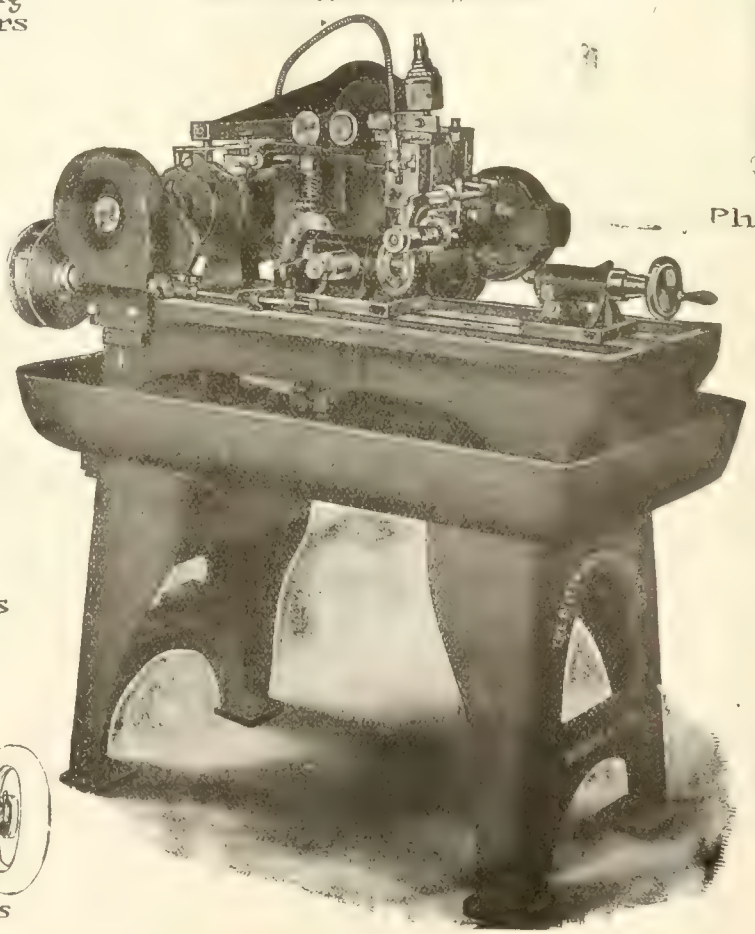

Milling Cutters

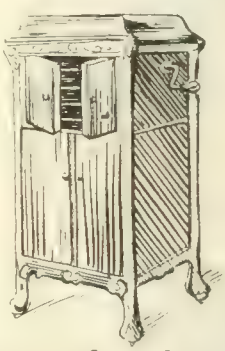

Gears



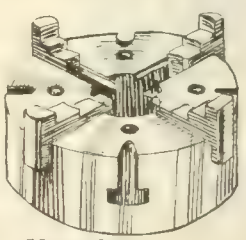
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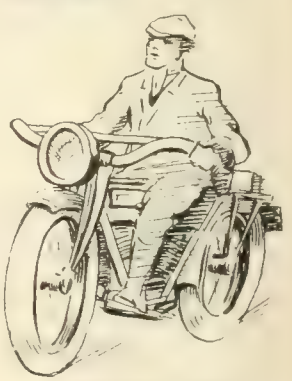

Automobiles




Locks

Phonographs


Chucks


Motorcycles

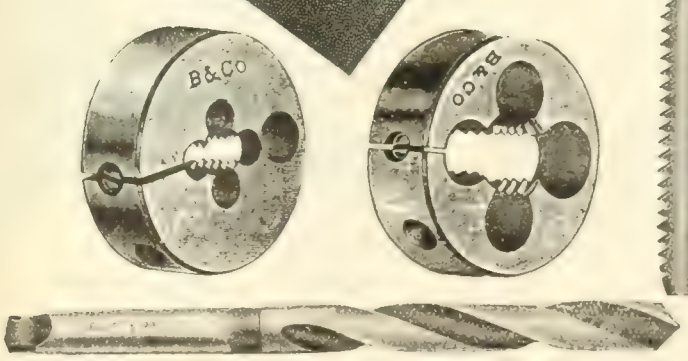
BILTON MACHINE TOOL COMPANY

Housatonic Avenue, BRIDGEPORT, CONN.

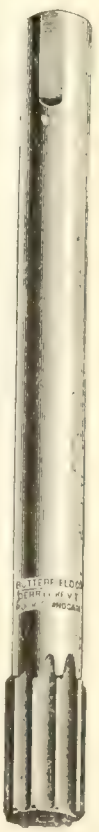
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Get acquainted with the Butterfield line by measuring its service by the test of long, hard service.

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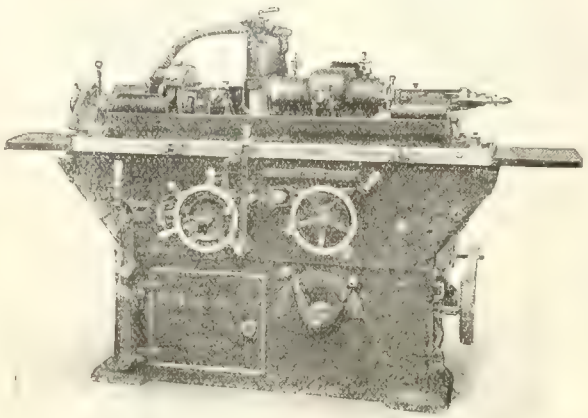
May we send a trial order?

Butterfield & Co., Inc.
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Toronto Office: 220 King St. W.

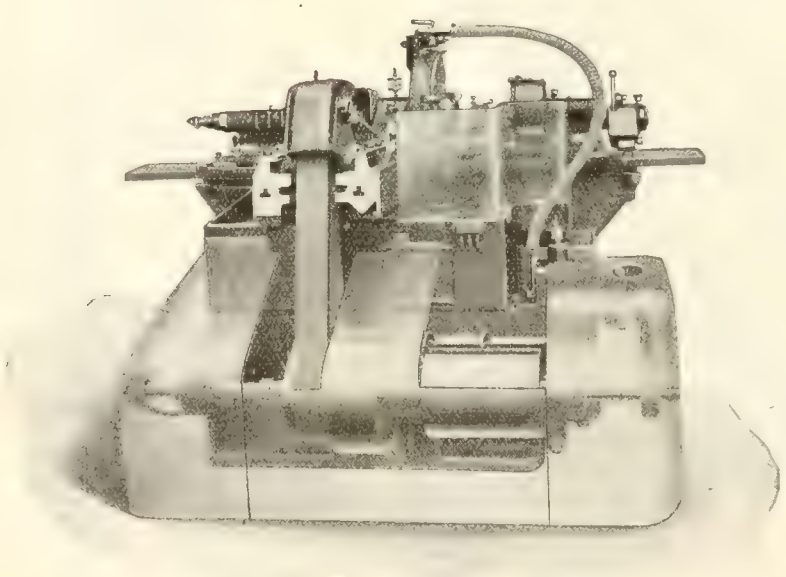
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PLAIN GRINDERS



The Success of Modern Plain Grinders results chiefly from all around superiority.



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—They're dependable—rugged and rigid. Do not easily get out of order.

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—Moderns are made in 10 sizes, 8″ x 18″ to 16″ x 60″.

Send us blueprints and specifications and we'll prove Modern's ability on your job.

Send for complete technical bulletin.

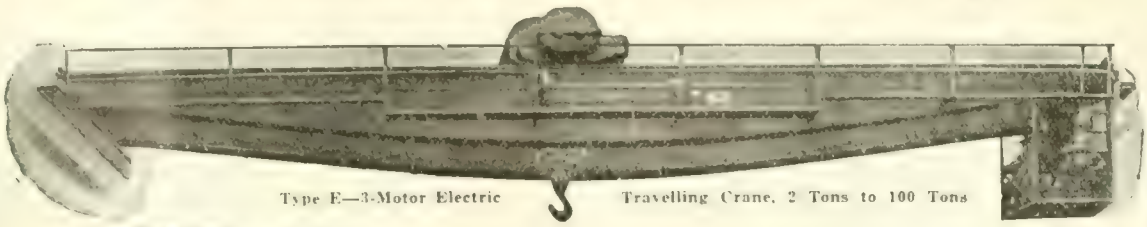
MODERN TOOL CO., ERIE, PA.

Main Office and Works: State and Peach Sts.

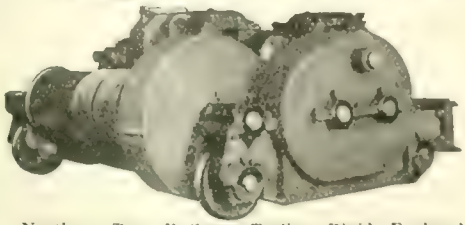
Canadian Agents, Rudel-Belnap Machinery Co., Ltd., Toronto and Montreal

CANADIAN MADE CANADIAN MADE

Electric and Hand Traveling Cranes



Type E—3-Motor Electric Travelling Crane, 2 Tons to 100 Tons

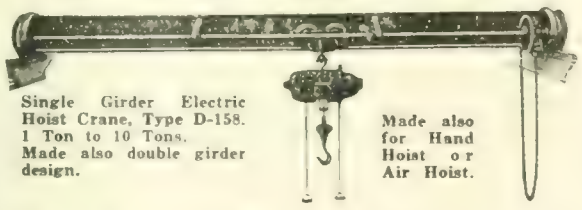


Northern Type E Crane Trolley, Rigid, Enclosed Construction. Patented in Canada.

We make a wide range of CRANE and HOIST designs. All sizes and capacities, 1 ton to 100 tons.







Single Girder Electric Hoist Crane, Type D-158. 1 Ton to 10 Tons. Made also double girder design.

Made also for Hand Hoist or Air Hoist.

Get our prices and specifications before you buy.

In asking prices, state SERVICE, CAPACITY, SIZE OR SPAN POWER, and, if electric, KIND OF CURRENT.

Catalogs free.

Type D Electric Hoists —½ to 10 Tons.

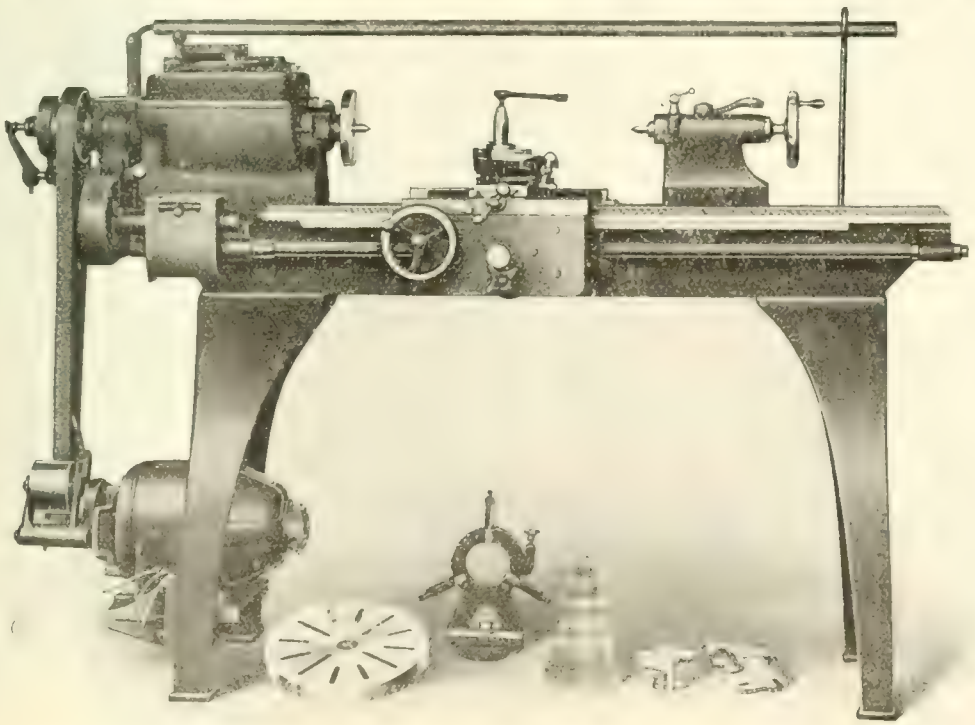
Air Hoists, Trolleys and Tracks.

Type No. 20 Air Hoist.

Northern Crane Works, Limited

Walkerville, Ontario, Canada

WORCESTER LATHES



12" and 14" Swing, Cone or Geared Head, Single Pulley or Motor Drive

WORCESTER LATHES are high grade throughout, only the best of workmanship and materials being used in their manufacture.

Their alignments are particularly good, and their wearing surfaces are sufficiently generous and substantial to maintain exceptional accuracy for a long time.

Write for complete information.

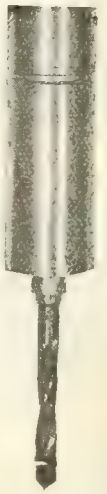
WORCESTER LATHE CO., WORCESTER, MASS.

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2 Minutes or 20?



This Is The Vital Question



Do you drill ten holes in the time it takes for one? The Hoefer Auxiliary Head equips any driller so as to accomplish this big saving in time. It speeds up production in drilling tremendously. Not only do you save the drilling time, but also the time now lost in shifting the jigs and raising and lowering the spindle for the extra holes.

Hoefer Auxiliary Heads are made in any multiple, arranged in any manner, from 2 up. They are made by expert tool makers and unqualifiedly guaranteed to handle accurately the work for which they are designed.

Investigate now—every day you use a single drill where the multiple may be used you are paying for an auxiliary head through increased costs, but not securing its benefits.

Write for catalog. Send a blueprint of some of your work for estimate of time and cost.

THE HOEFER Mfg. Co., Freeport, Ill.

621 Washington Blvd., Phone Haymarket 2408, Chicago, Illinois; 1113 Citizens' Bldg., Phone Main 795, Cleveland, Ohio; 217 Stanwix St., Phone Court 1911 or 1912, Pittsburgh, Pa.; 602 Kerr Building, Phone Cherry 2884, Detroit, Mich.; 30 Church Street, Phone Cortland 1615, New York City; Badger-Packard Mchy. Co., Milwaukee, Wisconsin; National Supply Co., Toledo, Ohio; John M. Howett, 18 W. Second St., Dayton, Ohio; 881 Ellicott Sq., Phone Seneca 2033, Buffalo, N.Y.

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Manhattan

Universal Tool Grinder

Capable of handling cylindrical or internal grinding with speed and accuracy.



An invaluable tool to the machine shop where there is a large variety of grinding to be done. Complete equipment.

Manhattan Machine & Tool Co.

Grand Rapids, Mich., U.S.A.

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PERRIN FOR RELIABILITY

Hydraulic Screw and Filter Presses

Made in Canada

Hydraulic Truck Tire Press

WILLIAM PERRIN LIMITED

TORONTO

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The Connecting Link between Power and Production

MAXIMUM production can only be attained through uninterrupted transmission of power from lineshafts to machines. Belts *will* break. Because no method to-day equals the "Clipper" for speedy repairs, "Clipper" belt hooks are the connecting links between power and production. "Clipper" hooks make possible practically continuous operation of machines during working hours in the workshops of the world.

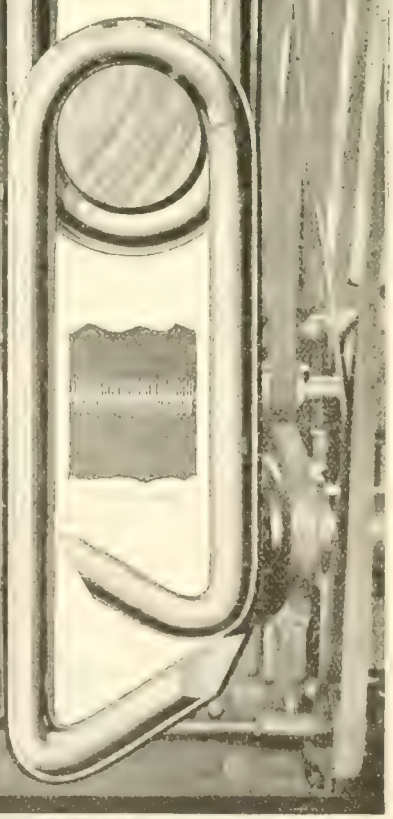
The Clipper Belt Lacer
Laces a Belt in Three Minutes

Out-of-date methods take from ten minutes to half an hour. The "Clipper" makes a durable joint—one that is smooth on both sides, is as flexible as the belt itself, is safe and pulls right.

The "Clipper" goes to manufacturers on free trial and is perpetually guaranteed.

Clipper distribution is world-wide through mill-supply houses. Where we are yet open for representation our dealer proposition is one of mutual profit.







Clipper Belt Lacer Co.

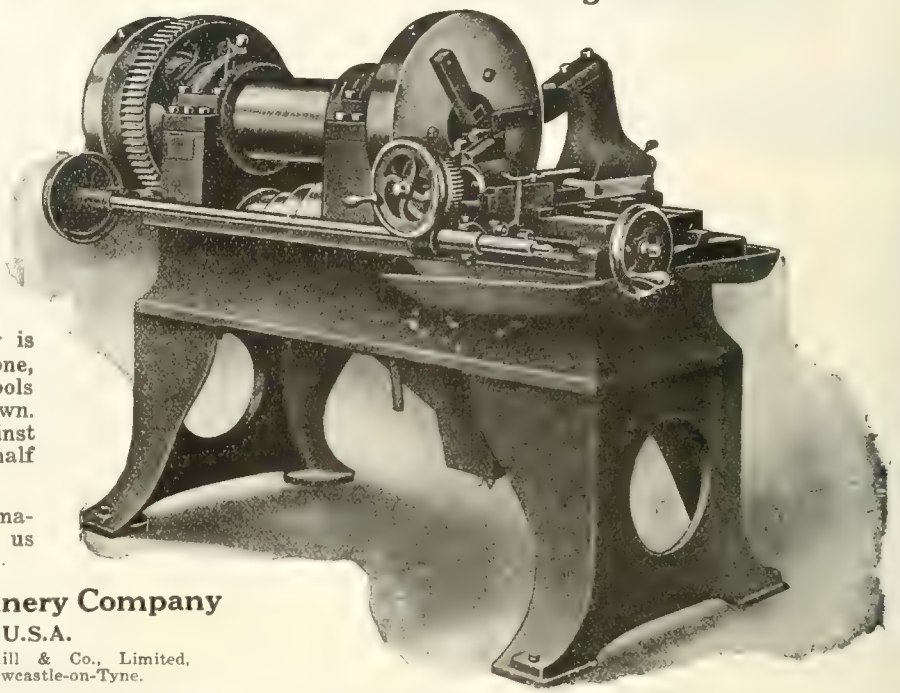
Clipper Belt Lacer Company
GRAND RAPIDS, MICHIGAN, U. S. A.
LONDON, ENGLAND—NO. 10 NORFOLK STREET

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Cut Your Cutting-off Costs in HALF

HURLBUT'S

Patent Cutting-off and Centering Machines



TO say that the Hurlbut, Rogers Cutting-Off and Centering Machine will **double your production** and **cut your costs in half** may seem like a broad claim. But this is just what this machine will do compared with any ordinary machine of its kind.

Hurlbut, Rogers speed and efficiency is easily explained. Instead of only one, it is equipped with two cutting-off tools —one cutting up and the other down. In this way they hold the work against each other and finish a job in just half the time and do twice the work.

You can't afford to be without this machine. It saves real money. Let us tell you more about it. Write!

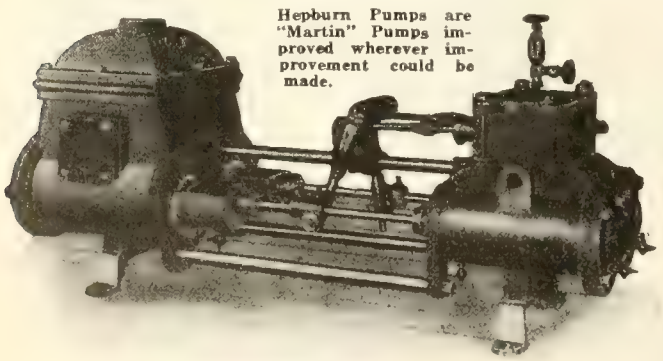
The Hurlbut, Rogers Machinery Company

South Sudbury, Mass., U.S.A.

Foreign Agents—England: Chas. Churchill & Co., Limited, London, Manchester, Glasgow and Newcastle-on-Tyne.

Hepburn Pumping Machinery

Our line embraces **standard duplex pumps for boiler feeding and for fire and general service; tank or low service duplex pumps; duplex hydraulic pumps for service in connection with hydraulic lifts and presses, accumulators and oil presses; pressure or mine pumps; horizontal power pumps and air and circulating pumps, etc.**

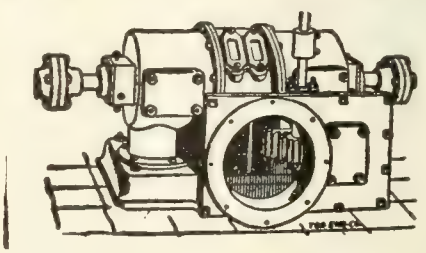


Hepburn Pumps are "Martin" Pumps improved wherever improvement could be made.

JOHN T. HEPBURN, LIMITED

18-60 Van Horne Street Toronto, Ontario

WATER POWER DEVELOPMENT



Over forty years' experience in designing and installing special turbines, both on vertical and horizontal shafts.

Can supply complete equipment, including flume, turbine and power transmission.

Stock of standard vertical shaft Little Giant Turbines on hand for prompt shipment.

We solicit your inquiries.

THE J. C. WILSON MFG. CO. LIMITED

BELLEVILLE, ONTARIO

Gear Cutting with the "IF'S" Left Out

The Gear Shaper Way

A production manufacturer knows that he will secure good gears IF he has an accurate cutter, an accurate machine and a machine working on the correct principle. The whole question of good gears is resolved in this one little word "IF."

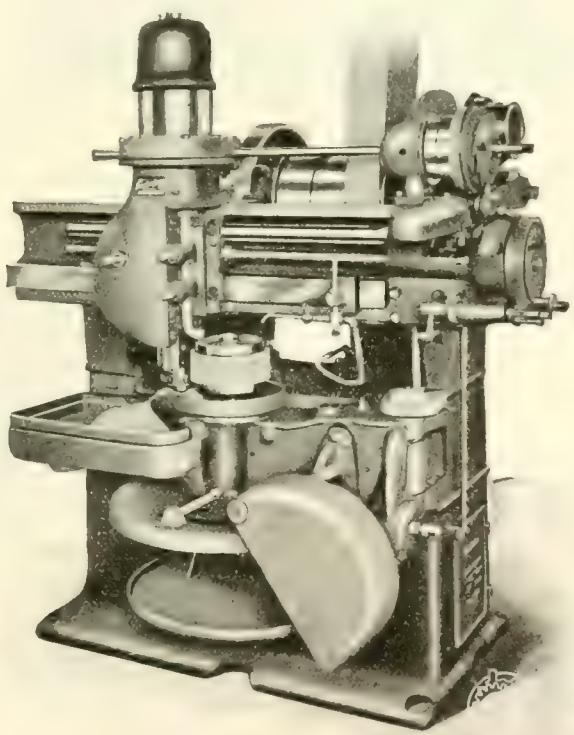
When the Gear Shaper was originally designed, the question of "IF" was taken into consideration and every possible means known to mechanical engineering was employed to eliminate the "IFS" from gear cutting.

That we have been successful in solving the problem is evidenced by the fact that each ensuing year sees a larger number of manufacturers adopting the Gear Shaper method.

How the Gear Shaper has accomplished this is clearly explained in our general catalog "Commercial Gear Cutting," which is a treatise on the subject of:—

Gear Cutting with the "IFS" Left Out.

Send for your copy to-day



The Fellows Gear Shaper—the machine which has taken the "IFS" out of gear cutting.

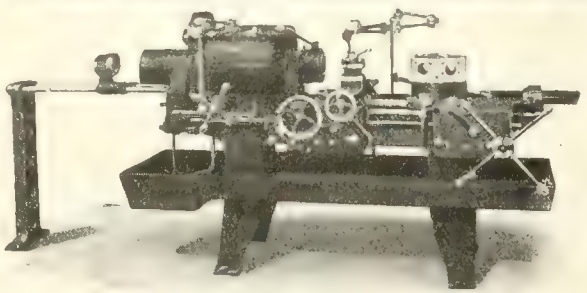
The Fellows Gear Shaper Company

Springfield, Vermont, U.S.A.

FOREIGN AGENTS:—Alfred Herbert, Limited, Coventry, England; Sociéte Anonyme Alfred Herbert, Paris, France, Societa Anonima Italiana Alfred Herbert, Milan, Italy; Alfred Herbert, Limited, Yokohama, Japan; Societe Anonyme Alfred Herbert, Barcelona, Spain; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium; Alfred Herbert, Limited, Calcutta, India; A. B. Galco, Limited, Stockholm, Sweden.

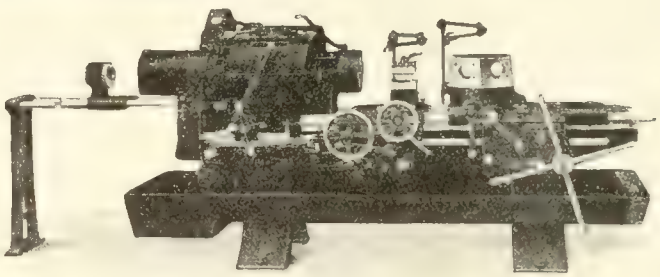
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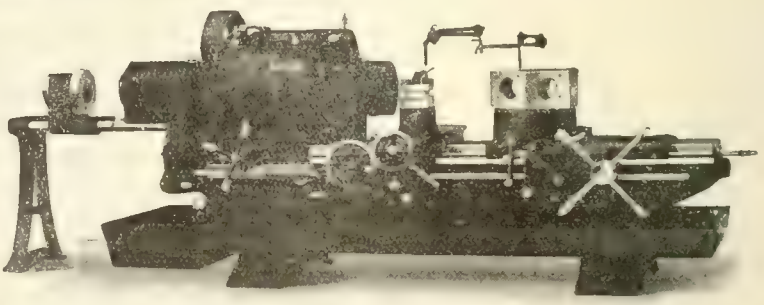


BAR CAPACITY FOSTER UNIVERSAL TURRET LATHE

1-B
2" x 20"



2-B
3¼" x 30"



3-B
4½" x 40"

HOW ARE YOU EQUIPPED FOR BAR WORK?

Have you checked up the machining cost of your shafts and other bar work lately? Are you keeping the cost down to the old level and at the same time increasing the wages of your men and thus making them able to meet the steadily mounting cost of the necessities of life?

Some people have not analyzed their cost figures yet.

Others have.

The Foster Universal Turret Lathes are capable of increasing your production per man. We are not particularly interested in what equipment you are using now; we **know that** we can increase your production.

The machines have the power. It is now a question of how heavy a cut the tool will stand up under, not of whether the machines will pull.

The general design of the machine, the reducing the overhang to minimum, the weight and massiveness of the bed lend rigidity in a high degree.

The centralized control saves the operator's time and energy, and increases your, and his earnings.

It will pay you to investigate the merits of the Foster Universal Turret Lathes. Your competitors probably have one or several of these machines in their factory already. If they do it has given them the drop on you.

OUR CATALOGUE SHOULD BE IN YOUR FILE—WRITE TO-DAY.

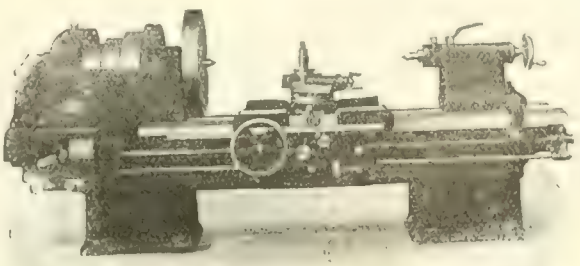
FOSTER MACHINE CO., ELKHART, IND.

SIDNEY

Sidney for Service

Heavy Duty Engine Lathes

Sidney-for-Service Lathes are noted for their power and rigidity. Take deep cuts through toughest metal without pause or chatter.



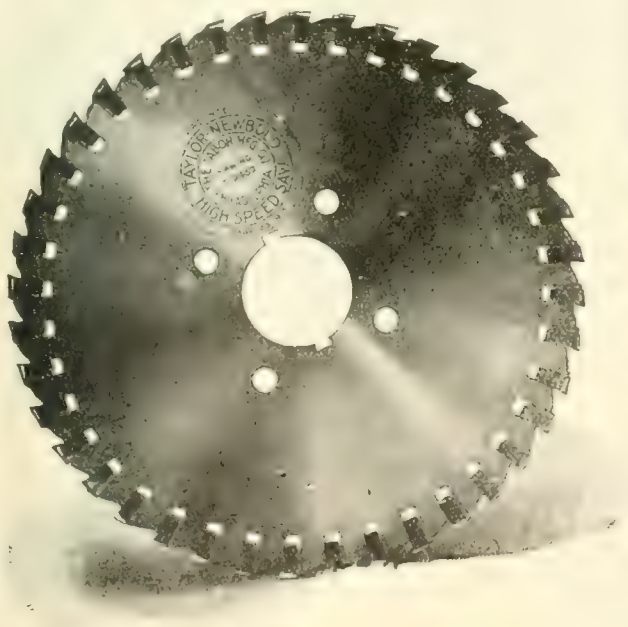
Specifications include 3-step cone, double brake gear, semi-quick change gear lathe, built on 10 ft. bed. This lathe also furnished with quick-change gears. Bed lengths available: 10, 12, 14, 16, 18 and 20 ft.

The Sidney line comprises 15-inch, 17-inch, 19-inch, 25-inch, 27-inch, 30-inch and 36-inch lathes, which are adaptable to the finest tool room work or the heaviest duty shipyard or factory rapid production work.

The Sidney Tool Company, Sidney, Ohio

Canadian Agents: Yeates Machinery & Supply Co., Montreal, Que.
H. W. Petrie, Limited, Toronto, Ontario

THE IMPROVED
TAYLOR-NEWBOLD

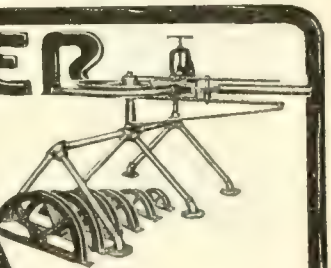


INSERTED TOOTH COLD SAW

WRITE FOR BULLETIN T-S

Tabor Mfg. Co., Philadelphia, Pa., U.S.A

WONDER
"Bending Machines"



DON'T WASTE ELBOWS

BEND PIPE COLD

ELIMINATE FRICTION

2 New Models

"Wonder" Pipe and Tube Bending Machines (pat.) electrically operated to bend from 1" to 8".

We also manufacture 10 other sizes

Hand operated to bend from ⅛" to 6".

American Pipe Bending Machine Company

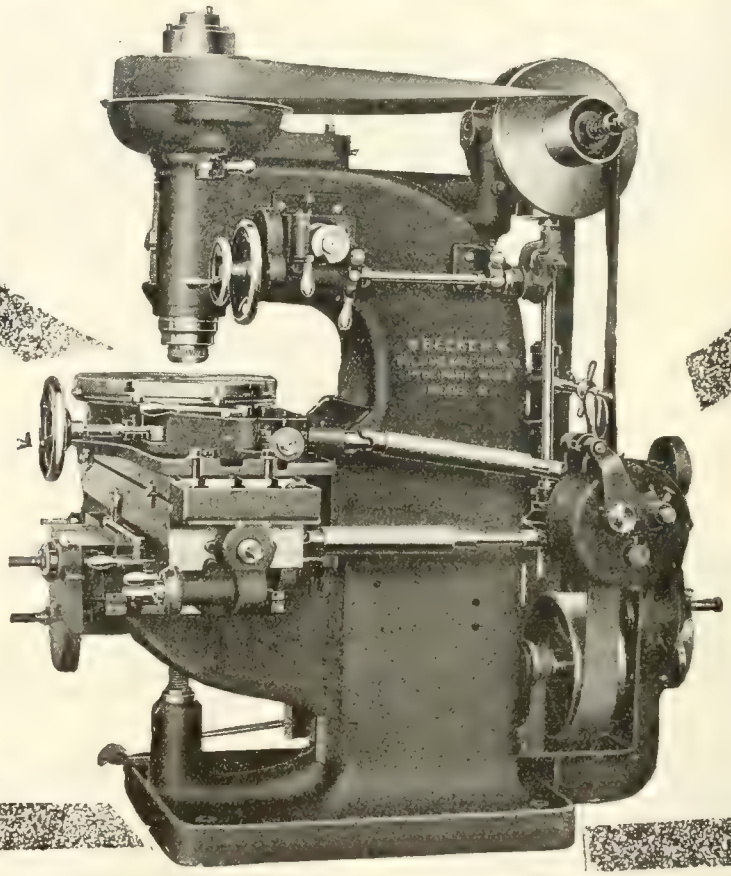
52 Pearl Street

BOSTON, MASS. U. S. A.

The Canadian Fairbanks-Morse Co., Ltd., Montreal, Que., Agents for Canada

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Becker



"Becker Belt Driven Millers"

The Machine that gives the Smooth Finish

Model B

The machine shown above is a Becker Model B Belt Driven Miller—Like the other machines of this line it is a Production Tool of the first class, embodying all the features that have made Becker Millers the standard.

The strenuous period of war work has introduced Becker Belt Driven Millers into Canadian factories. They were essential then because they greatly increased production without adding to manufacturing costs—and now, they are essential also because they will enable you to reduce your manufacturing costs in order to cope with the keen after-war competition.

You need a Becker Belt Driven Miller.

Write for Circular O-501—NOW.

BECKER MILLING MACHINE COMPANY

Hyde Park, Boston, Mass

Canadian Agents:

Rudel-Belnap Machinery Company, Ltd., 137 McGill St., Montreal.

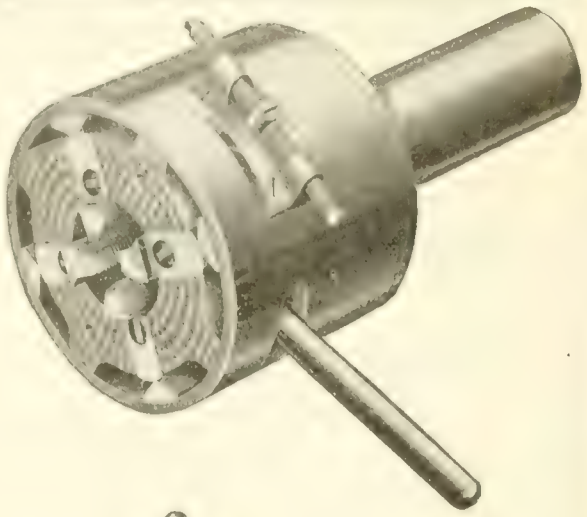
A. R. Williams Machinery Company, Ltd., 64 Front St. West, Toronto.

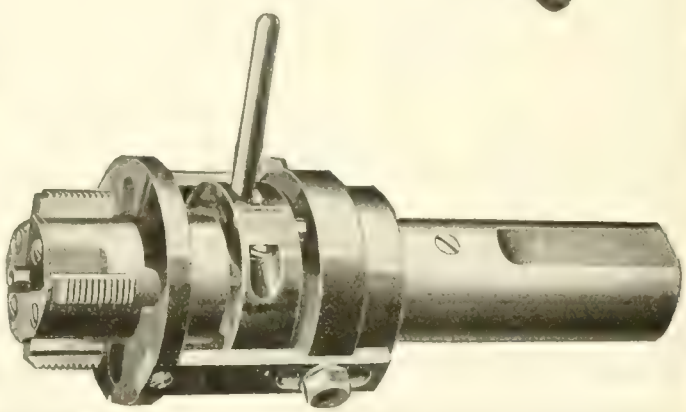
NAMCO DIES TAPS

It doesn't make a bit of difference whether it's threading screws or tapping axle housings, there's a NAMCO Threading Tool for every thread cutting requirement.

NAMCO Dies and Taps are simple in design, rigid in construction to cut threads true to specification on all classes of work.

Ask for catalog--no obligation





The National Acme Company

CLEVELAND, OHIO

New England Plant - Windsor, Vt.
Canadian Screw Plant - Montreal, P.Q.

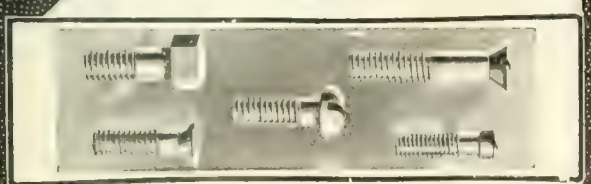
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Makers of Gridley Single and Multiple-Spindle Automatics at Windsor, Vermont, and Acme Automatics, Threading Dies, and Screw Machine Products, at Cleveland, Ohio

Wood Screw Making Machinery

SEND FOR CATALOGUE
Series B6



For sixty years we have constantly manufactured machinery for making screws, always studying to improve and refine our product.

Write or Wire us.

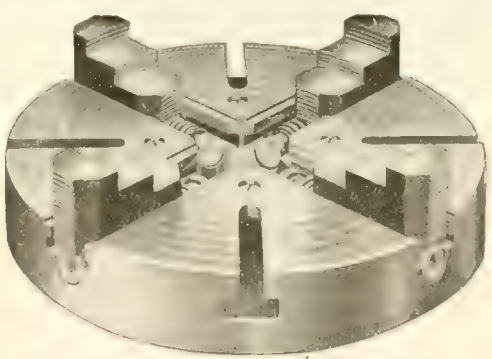
Cable address: "Cook,"
Hartford, U.S.A.
Codes: Liebers
Western Union

Asa S. Cook Co.
Hartford, Conn.

ALL STEEL

INDEPENDENT CHUCKS

are not an experiment—they have come to stay. They are a necessity with the modern machinery and high-speed steel cutting tools.



THE UNION STEEL BODY CHUCKS

are well designed and have all the elements of strength and durability for which they are designed. We make other types in steel also, including the Geared Scroll Chucks and the Geared Scroll Combination—all designed for heavy work and hard usage.

UNION MANUFACTURING COMPANY

New Britain, Conn.

New York Office: 26 Cortlandt Street

Makers of a complete line of chucks

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Second Hand Cisco Lathes are Scarce

They use them right along for years.
They are well designed—well built—made to wear.
(Why, the first CISCO lathe, made in 1909, is still being run and has never been repaired but once. That was a slight repair, too.)
They are not intricate, yet do the work well.
They have not a waste pound, yet are powerfully heavy.
They have no jimcracks, nor a mass of levers, yet are accurate.

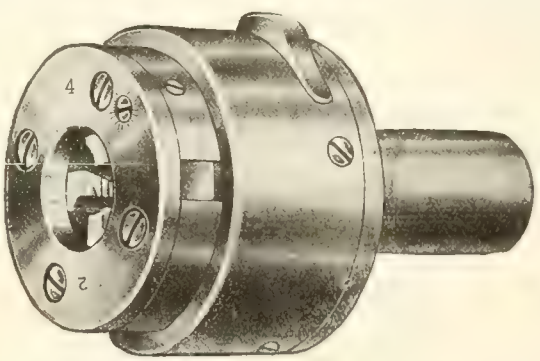
Put Them All Over Canada

Get shop results—save time—please employees—make money. We build them in 14″, 16″, 18″, 20″, 24″, 26″ engine or tool room sizes.

Plain or geared head. Belt or motor driven.

THE CISCO MACHINE TOOL COMPANY
CINCINNATI, U.S.A.

Have you a copy of our latest Booklet, describing THE LATHE WITH THE PULL
THE LATHE OF SIMPLIFIED ACCURACY



H & G Die Heads

are of small outside diameter compared with the size of work they do.

The H. & G. illustrated is an automatic, self-opening Die Head designed especially for use on Gridley and National Acme Multiple Spindle Screw Machines and others that use the die in a revolving position. The four sizes of this Head cut up to 9/16″, 1″, 1¼″ and 1½″.

All parts are hardened and ground and interchangeable. In a word—it's an H. & G.

Ask for Catalog

Eastern Machine Screw Corp.
New Haven, Conn., U.S.A.

Cushman's Booklet

of Essential Chucks

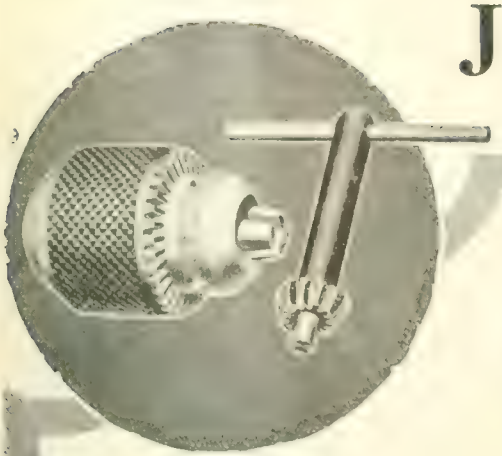


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THE CUSHMAN CHUCK CO. HARTFORD, CONN., U.S.A.

JACOBS CHUCKS



Jacobs Improved Drill Chucks do their part. They never disappoint the mechanic---no drill breakage ---no lost motion.

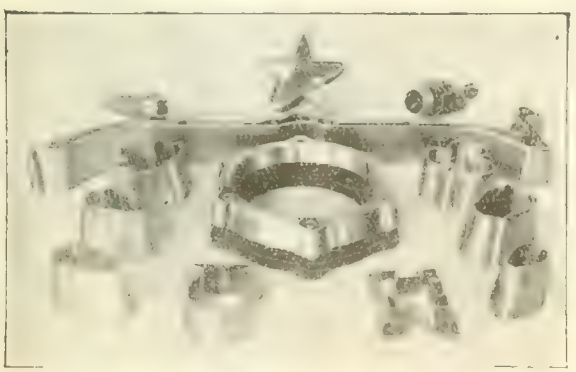
Equip all your machines with them.

ADDRESS DEPARTMENT C.M.

THE JACOBS MFG. CO. HARTFORD, CONNECTICUT, U.S.A.

Quality Cutting Dies

For All Purposes



Our experience is varied in this line of work and we are completely equipped to handle any kind of Cutting Die Works.

The picture shows you a few of the many kinds and styles, such as Envelopes, Labels, Lithographs and Advertising Novelties, Boxes, Wrappers, Gaskets, Paper Napkins, Drinking Cups, etc., Cutting Dies which we manufacture.

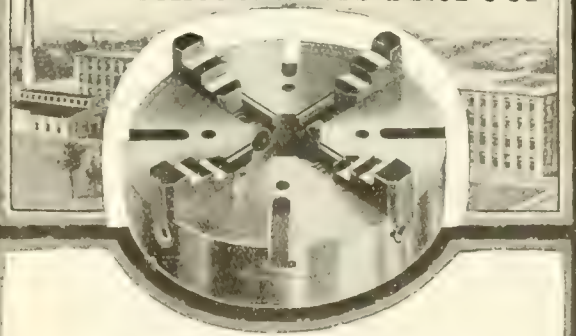
We solicit your inquiries

The Hoggson & Pettis Mfg. Co.

New Haven, Conn., U. S. A.

Sold by Geo. F. Foss Machinery & Supply Company, Limited, 305 St. James St., Montreal.

THE PLANT AND ITS PRODUCT



SKINNER CHUCKS

Whether the work requires a powerful chuck with accurately adjusted, easily operated, effective jaws that grip and hold large work—or a small chuck for delicate and unusually precise work—there's a chuck in the Skinner Line that will best meet the requirements.

Our illustrated literature will interest you--
Shall we send it?

The Skinner Chuck Co.

NEW BRITAIN, CONN.

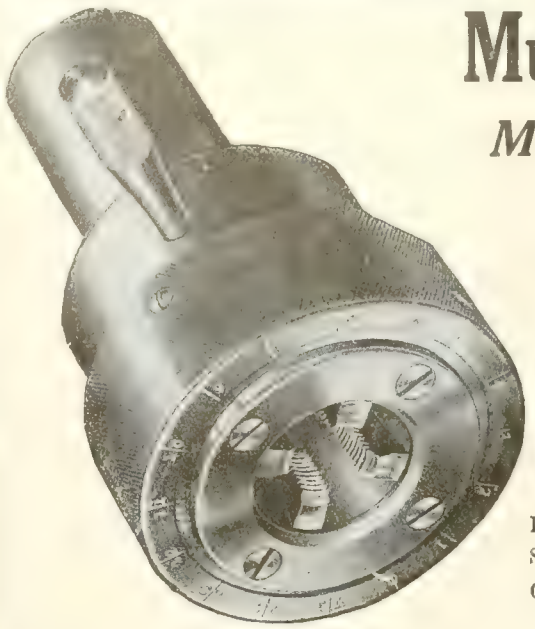
New York Office: 94 Reade St.

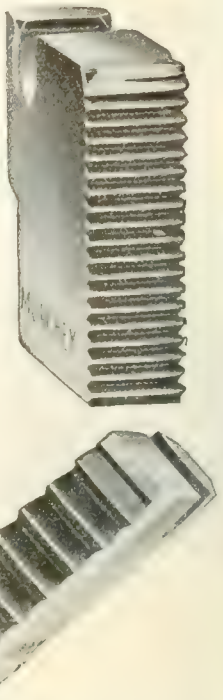
San Francisco Office: Rialto Bldg.

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Murchey Chasers

Mean Quick Deliveries





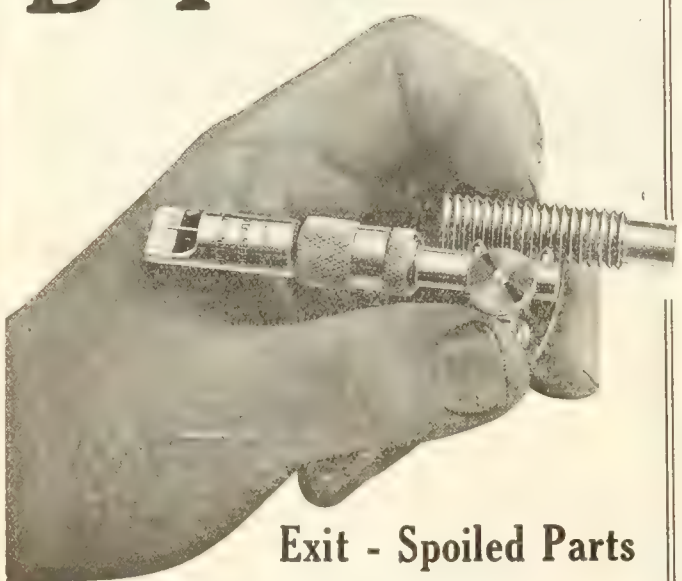
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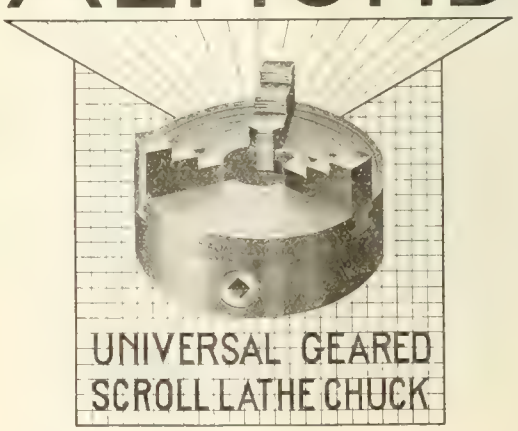
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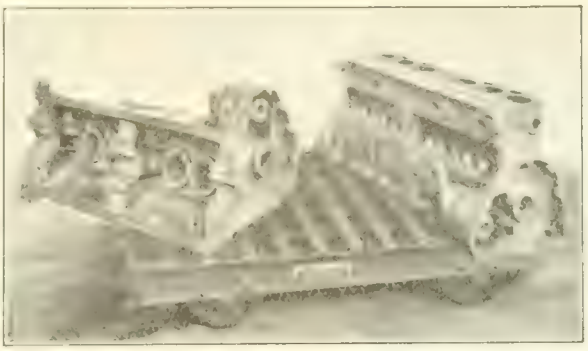
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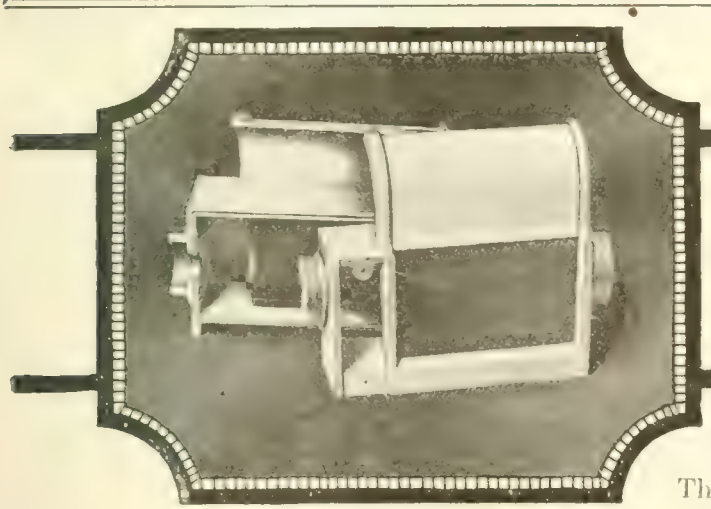
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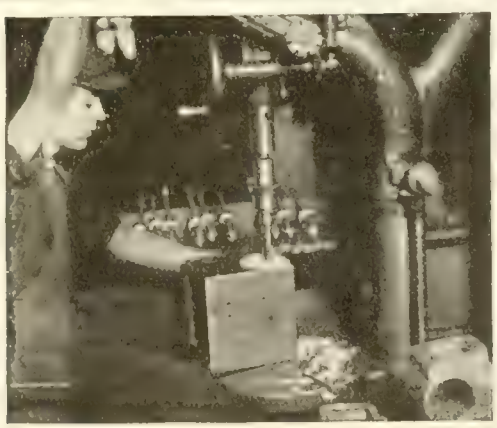
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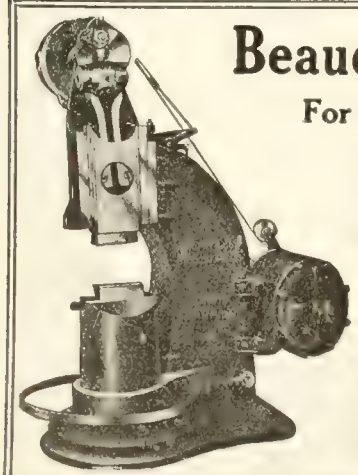
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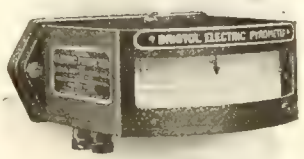
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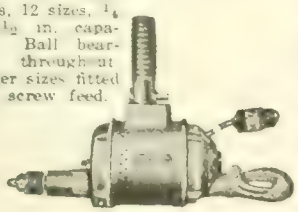
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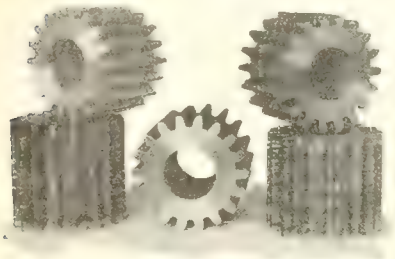
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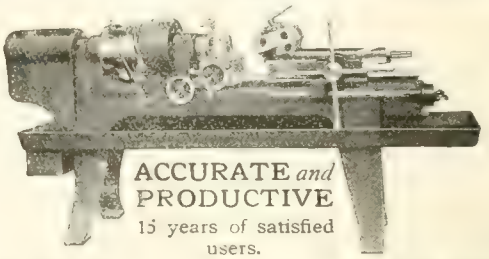


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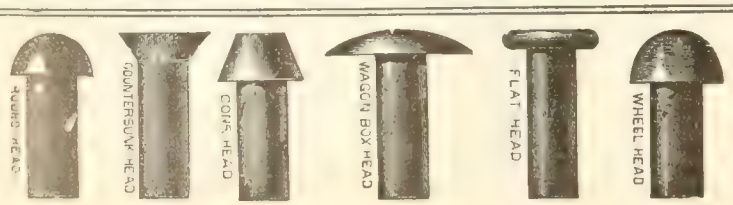
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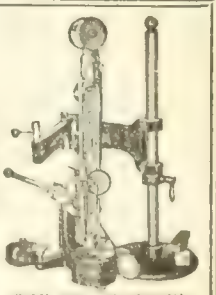


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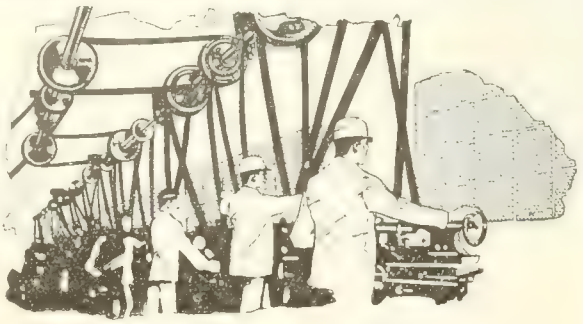


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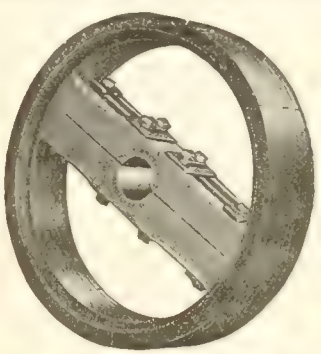
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Pratt & Whitney Co., Dundas, Ont.
Roelofson Machine & Tool Co., Toronto.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson Ltd., Montreal, Que.

AUTOMATIC METAL CUTTING-OFF MACHINES
Greenfield Tap & Die Corp., Greenfield.
Wells Bros. of Can., Galt, Ont.
Aikenhead Hardware Co., Toronto, Ont.
Canadian Fairbanks-Morse Co., Montreal
Canada Metal Co., Toronto
G. E. Foss Mchy. & Sply. Co., Montreal.

AUTO SHEET METAL MACHINERY
Quickwork Co., St. Marys, Ohio.

AUXILIARY HEADS
Hoefer Mfg. Co., Freeport, Ill.

BABBITT METAL
Canada Metal Co., Ltd., Toronto, Ont.
Hoyt Metal Co., Ltd., Toronto
Magnolia Metal Co., Montreal.
Rice Lewis & Son, Toronto, Ont.
Tallman Brass & Metal Co., Hamilton.
Wilkinson & Kompass, Hamilton, Ont
Williams & Wilson, Limited, Montreal

BAND SAWS
Canada Machinery Corp., Galt, Ont
Oliver Machy. Co., Grand Rapids, Mich.

BALL BEARINGS
Canadian Fairbanks-Morse Co., Montreal
Can. S K F Co., Toronto, Ont.
Chapman Double Ball Bearing Company, Toronto
The Gray Ball Bearing Co., Ltd., Toronto
Morrow Screw & Nut Co., John, Ingersoll
Rochester Ball Bearing Co., Rochester.
Williams & Wilson, Ltd., Montreal, Que

BALLS, STEEL
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Biancke Co., L. C., New York City.
Chapman Double Ball Bearing Co., Toronto
Boker & Co., Inc., Montreal, Que.
Gray Ball Bearing Co., Ltd., Toronto.
Rochester Ball Bearing Co., Rochester.
Marshall, Son & Bunney, Toronto.
Williams & Wilson, Limited, Montreal

BALLS, BURNISHING
Gray Ball Bearing Co., Ltd., Toronto.

BAROMETERS
Taylor Instrument Co., Rochester, N.Y.

BARRELS, SAND-BLAST
Pangborn Corp., Hagerstown, Md.

BARRELS, STEEL SHOP
Baird Machine Co., Bridgeport, Conn.
Cleveland Wire Spring Co., Cleveland.

BARRELS, TUMBLING
Baird Machine Co., Bridgeport, Conn.
Katie Foundry, Galt, Ont.
Northern Crane Works, Walkerville, Ont.
Wilson & Co., J. C., Belleville, Ont.
Williams & Wilson, Ltd., Montreal, Que.

BASE FACING MACHINES
Victoria Foundry Co., Ottawa, Ont.

BARS, BORING
Gisholt Machine Co., Madison, Wis.
Niles-Bement-Pond Co., New York.
Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

BARS, MERCHANT
Algoma Steel Corp., Sault Ste. Marie.

BARS, CONCRETE REINFORCING
Algoma Steel Corp., Sault Ste. Marie

BEADING MACHINES
Quickwork Co., St. Marys, Ohio

BELT CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Williams & Wilson, Limited, Montreal

BEARINGS, BRONZE
Wilson & Co., J. C., Belleville, Ont.

BEARINGS, DIE CAST
Brightlon Mfg. Co., Syracuse, N.Y.

BELT-LACING MACHINES, HOOKS AND PINS
Clipper Belt Lacer Co., Grand Rapids

BELT LACING LEATHER
Aikenhead Hardware Co., Toronto, Ont.
G. E. Foss Mchy. & Sply. Co., Montreal.
Graton & Knight Mfg., Worcester, Mass.
Rice Lewis & Son, Toronto, Ont.

BELTING, BALATA
Federal Engineering Co., Toronto, Ont.

BELT HOOKS, WIRE
Clipper Belt Lacer Co., Grand Rapids

BELTING, RUBBER
Can. Consolidated Rubber Co., Montreal.

BELTING, CHAIN
Can. Fairbanks-Morse Co., Montreal.
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.
Whitney Mfg. Co., Hartford, Conn
Williams & Wilson, Ltd., Montreal, Que.

BELTING, CONVEYOR
Can. Consolidated Rubber Co., Montreal.
Baxter & Co., Ltd., J. R., Montreal
Canadian Fairbanks-Morse Co., Montreal
Federal Engineering Co., Ltd., Toronto
Graton & Knight Mfg., Worcester, Mass.
Jones & Glassco, Montreal, Que.
McLaren Belting Co., J. C., Montreal.
Morse Chain Co., Ithaca, N.Y.
Plewes, Ltd., Winnipeg, Man.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Williams & Wilson, Ltd., Montreal, Que.

BELTING, FRICTION AND SURFACE
Can. Con. Rubber Co., Ltd., Montreal.

BELTING, LEATHER
Can. Graton & Knight Mfg. Co., Montreal
John Tullis & Son, Glasgow, Scotland.

BELTING, WOVEN
Federal Engineering Co., Ltd., Toronto

BENDING ROLLS, PLUTE & AUGH
Wickes Bros., Saginaw, Mich.

BENDING MACHINERY
Bertrams, Ltd., Edinburgh, Scotland.
Bertram & Sons Co., John Dundas
Brown-Boggs Co., Ltd., Hamilton, Ont.
Can. Blower & Forge Co., Kitchener
Garlock-Walker Mach. Co., Toronto.
Williams & Wilson, Ltd., Montreal.

BLAST GATES
W. S. Rockwell Co., New York, N.Y.

BLASTING MACHINES, SAND
Garlock-Walker Machinery Co., Toronto.
Jardine, A. B., & Co., Hespeler, Ont.
National Mach. Co., Tiffin, Ohio.
Niles-Bement-Pond Co., New York
Toledo Machine & Tool Co., Toledo
Williams & Wilson, Limited, Montreal.

BILLET MARKERS
Matthews & Co., Jas. H., Pittsburgh, Pa.

BILLETS
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Swedish Steel & Importing Co., Ltd., Montreal
Algoma Steel Corp., Sault Ste. Marie.
Kayser Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto
Norton, Ralph B., Agent, Montreal.

BILLETS, FORGING
General Steel Co., Milwaukee, Wis.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal.

BINS, STEEL
Dennis Wire & Iron Works, London, Ont
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Toronto Iron Works, Ltd., Toronto, Ont.
William Hamilton Co., Peterboro, Ont.

BLACKSMITH WORK
The Thos. Pink Co., Ltd., Pembroke

BLASTING MACHINES, SHOT AND STEEL GRIT
Pittsburgh Crushed Steel Co., Pittsburgh

BLOOMS AND SLABS
Algoma Steel Corp., Sault Ste. Marie.

BLOWERS
Can. Blower & Forge Co., Kitchener, Ont.
Garlock-Walker Machinery Co., Toronto.
Macdonald & Co., Montreal, Que.
Williams & Wilson, Limited, Montreal.

BLOW PIPES AND REGULATORS
Carter Welding Co., Toronto, Ont.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

BLUE PRINTING MACHINERY
Commercial Camera Co., Providence, R.I.
Wickes Bros., Saginaw, Mich.

BLUE PRINT PAPER
Hughes, Owens Co., Ltd., Montreal, Que.

BOARDS, GLASS CUTTING
Lufkin Rule Co., of Can., Windsor, Ont.

BOARTZ
Joyce, Koebel & Co., Inc., New York.

BOLT CUTTERS
Greenfield Tap & Die Corp., Greenfield, Mass

BOILER BREECHINGS
William Hamilton Co., Peterboro, Ont.

BOILER FEEDING TRAPS
Geo. W. Cole, Ltd., Toronto

BOLT CUTTERS
Fellows Gear Shaper Co., Springfield, Vt.
Greenfield Tap & Die Corp., Greenfield, Mass
Wells Bros., of Can., Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que.

BOOKS, TECHNICAL
MacLean Publishing Co., Toronto.

BOILERS
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.

BOLT CUTTERS AND NUT TAPERS
Aikenhead Hardware Co., Toronto, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto
Landis Machine Co., Waynesboro, Pa.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Rice Lewis & Son, Toronto, Ont.
Wells Bros. Co. of Canada, Galt, Ont.
Williams & Wilson, Limited, Montreal.

BOLTS
Aikenhead Hardware Co., Toronto, Ont.
London Bolt & Hinge Wks., London, Ont.
Morrow Screw & Nut Co., John, Ingersoll.
Rice, Lewis & Son, Toronto, Ont.
Steel Co., of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Co., J. H. Brooklyn, N.Y.

BOLTS, COUPLING
Galt Machine Screw Co., Ltd., Galt, Ont.

BOLTS, STAY
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, SPRING SHAKLE
Can. Winkley Co., Ltd., Windsor, Ont.
Morrow Screw & Nut Co., John, Ingersoll.

BOLTS, PATCH
Morrow Screw & Nut Co., John, Ingersoll.

BOLT AND NUT MACHINERY
Bertram & Sons Co., John, Dundas, Ont.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Gardner & Son, Robt., Montreal
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
National Machinery Co., Tiffin, Ohio.
Williams & Wilson, Ltd., Montreal, Que.
Williams Machinery Co., A. R., Toronto

BOLT THREADING MACHINERY
Jardine & Co., Ltd., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., Cleveland, Ohio.
Victor Tool Co., Waynesboro, Pa.
Williams & Wilson, Limited, Montreal.

BORING MACHINES, PNEUMATIC CYLINDER
Cleveland Pneumatic Tool Co., Toronto.
Canadian Fairbanks-Morse Co., Montreal
Can. Ingersoll-Rand Co., Sherbrooke Que
Garlock-Walker Mach. Co., Toronto.

BORING MACHINES, UPRIGHT AND HORIZONTAL
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Garlock Walker Machinery Co., Toronto
Oliver Mach'y Co., Grand Rapids, Mich.
Gisholt Machine Co., Madison, Wis.
Hoefer Mfg. Co., Freeport, Ill.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que

BORING AND TURNING MILLS
Bertram & Sons Co., John, Dundas.
Betts Machine Co., Rochester, N.Y.
Canada Machinery Corp., Galt, Ont.
Gisholt Machine Co., Madison, Wis.
Foss Mch. & Sply Co., Geo. E., Montreal
Oliver Mach. Co., Grand Rapids, Mich.
Niles-Bement-Pond Co., New York.

BOXES, CAST IRON
Brown & Sharpe Mfg. Co., Providence, R.I.

BOXES, STEEL SHOP AND TOTE
[illegible] Box Stamping Co., Cleveland.

BRAKEBAND LINING CUTTERS
Peck, Stow & Wilcox Co., Southington, Conn.

BRAKES
Brown, Boggs & Co., Hamilton, Can.
Electric Steel & Metals, Ltd., Welland.

BRASS AND COPPER BARS, RODS BRAKES, CORNICES
Peck, Stow & Wilcox Co., Southington, Conn.

BRASS FOUNDERS
Canada Metal Co., Toronto
Greenleafs, Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton.
Wilson & Co., J. C., Belleville, Ont.

BRASS WORKING MACHINERY
Foster Machine Co., Elkhart, Ind.
Garlock-Walker Machinery Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Niles Bement Pond Co., New York.
Prest-O-Lite Co., Inc., Toronto, Ont.
Wood Turret Machine Co., Brazil, Ind.
Williams Machy. Co., A. R., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

BRICKS, RUBBING
Dominion Abrasive Wheel Co., Ltd., Mimico, Ont.

BRICKS, FIRE
Harbison-Walker Refractories, Montreal.

BRIDGES, RLY. AND HIGHWAY
Dominion Bridge Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.

BRONZE RODS AND SHEETS, PLATES
Brown's Copper & Brass Rolling Mills, New Toronto.

BRONZE, NAVAL
Brown's Copper & Brass Rolling Mills, New Toronto.
Canada Metal Co., Toronto.
Tallman Brass and Metal Co., Hamilton.

BRONZE COPPER
Canada Metal Co., Toronto.

BUFFING AND POLISHING MACHINERY
Ford-Smith Mach. Co., Hamilton.
Foss Mchy & S'ply Co., Geo. F. Montreal
Garlock-Walker Machinery Co., Toronto.
Williams & Wilson, Limited, Montreal.

BUCKETS, DUMP
MacKinnon Steel Co., Sherbroooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

BUCKETS, ELEVATOR
Can. Link-Belt Co., Toronto, Ont.
MacKinnon Steel Co., Sherbrooke, Que.

BUCKETS, CLAM SHELL, CRAB, DUMP
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Ltd, Walkerville.

BULLDOZERS
Bertram & Sons Co., John, Dundas.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Williams & Wilson, Limited, Montreal.

BURNERS, OIL AND NATURAL GAS
Northern Crane Works, Ltd., Walkerville.
W. S. Rockwell Co., New York, N.Y.

BURRS, IRON AND COPPER
Parmenter & Bulloch Co., Gananoque.

BUSHINGS, BRONZE
Morrow Screw & Nut Co., John, Ingersoll.

CALIPERS
Brown & Sharpe Mfg. Co., Providence, R.I.
Pangborn Corporation, Hagerstown, Md.
Peck, Stow & Wilcox Co., Southington, Conn.

CABINETS, SAND BLAST
Pangborn Corporation, Hagerstown, Md.

CABLE, ELECTRIC
International Machinery & Supply Co., Ltd., Montreal, Que.

CALKS, BOOT
Lufkin Rule Co., of Can., Windsor Ont.

CANADA SILVER SHEETS, ROLLS
Brown's Copper & Brass Rolling Mills, New Toronto.

CANNERS' MACHINERY
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

CANNERS' CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Wilson & Co., J. C., Belleville, Ont.

CARBIDE
Union Carbide Co., Toronto, Ont.

CARBONIZING BOXES
Can. Driver-Harris Co., Ltd., Walkerville
Katie Foundry, Galt, Ont.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont
Swedish Crucible Steel Co., Windsor.

CARRIERS, PNEUMATIC TUBE
Jones & Glassco, Montreal

CARS, INDUSTRIAL
Can. Blower & Forge Co., Kitchener, Ont
Can. Fairbanks-Morse Co., Ltd., Montreal
Elec. Steel & Metals, Welland, Ont.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Ltd., Herbert, Niagara Falls, Ont.

CASTINGS, MACHINERY
Wilson & Co., J. C., Belleville, Ont.

CASTINGS, ALUMINUM, BRASS BRONZE, COPPER, AND GUN METAL
Algoma Steel Corp., Sault Ste. Marie.
Brockville Foundry Co., Brockville, Ont.
Franklin Mfg. Co., Syracuse, N.Y.
Canada Metal Co., Ltd., Toronto, Ont.

CASTINGS, DIE CAST
Canada Metal Co., Ltd., Toronto, Ont.
Franklin Mfg. Co., Syracuse, N.Y.

CASTINGS, STEEL—ALL KINDS
Electric Steel & Metals Co., Welland.
Mesta Machine Co., Pittsburgh, Pa.

CARRIERS COUPLING BOLTS
John Morrow Screw & Nut Co., Ingersoll
Alexander Fleck, Ltd., Ottawa
Greenleafs Ltd., Belleville, Ont.
St. Lawrence Welding Co., Montreal.
Tallman Brass & Metal Co., Hamilton

CASTINGS, BENCH LEG.
Brown & Sharpe Mfg. Co., Providence, R.I.

CASTINGS, BRASS AND IRON
Algoma Steel Corp., Sault Ste. Marie
International Machinery and Supply Co., Ltd., Montreal, Que.

CASTINGS, BUILDING
Katie Foundry, Galt, Ont.

CASTINGS, GRAY IRON
Bernard Industrial Co., A., Fortierville, Q
Brown & Sharpe Mfg. Co., Providence, R.I.
Brown, Boggs Co., Ltd., Hamilton.
Alexander Fleck, Ltd., Ottawa.
Gardner & Son, Robt., Montreal.
Greenleafs, Ltd., Belleville, Ont.
Hull Iron & Steel Foundries, Ltd., Hull
International Malleable Iron Co., Guelph
Kennedy & Sons, Ltd., Wm., Owen Sound
Katie Foundry, Ltd., Galt, Ont.
Hamilton Co., Wm., Peterboro.
Wilson & Co., J. C., Belleville, Ont.

CASTINGS, PLUMBERS'
Katie Foundry, Galt, Ont.

CASTINGS, NICHROME
Can. Driver-Harris Co., Ltd., Walkerville

CASTINGS, HARDWARE
Katie Foundry, Galt, Ont.

CASTINGS, STEEL CHROME AND MANGANESE STEEL
Thos. Davidson Mfg. Co., Montreal, Que.
Dom. Foundries & Steel, Hamilton, Ont.
Hull Iron & Steel Foundries, Ltd., Hull.
Kennedy & Sons, Ltd, Owen Sound.

CASTINGS, MALLEABLE
International Malleable Iron Co., Guelph

CASTINGS, NICKEL STEEL
Hull Iron & Steel Foundries, Ltd., Hull.

CEMENT, IRON
Warmington & Co., J. N., Montreal, P.Q.

CEMENT, ELASTIC JOINTING
Warmington & Co., J. N., Montreal, P.Q

CEMENT MACHINERY
Can. Fairbanks-Morse Co., Ltd., Montreal.
Gardner, Robt., & Son, Montreal.

CEMENT HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.

CENTERING MACHINES
Victoria Foundry Co., Ottawa, Ont.

CENTRE REAMERS
Bertram & Sons Co., John, Dundas
Butterfield & Co., Inc., Rock Island, Que.
Gardner, Robt. & Son, Montreal.
Hurlburt, Rogers Mch Co., South Sudbury, Mass.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Niles Bement-Pond Co., New York
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Canada, Galt, Ont.
Whitman & Barnes Mfg. Co., Akron, O.

CHAIN, WELDED COIL
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

CHAIN BLOCKS
Aikenhead Hardware Co., Toronto, Ont.
Can. Fairbanks Morse Co., Ltd. Montreal
Ford Chain Block & Mfg. Co., Phila., Pa.
Garlock-Walker Machy Co., Toronto.
Morris Crane & HoistCo., Herbert, Niagara Falls, Ont.
Rice Lewis & Son, Toronto, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Jones & Glassco, Montreal, Que.

CHAINS, AGRICULTURAL
Morse Chain Co., Ithaca, New York.

CHAINS, AUTOMOBILE ENGINE
Morse Chain Co., Ithaca, New York.

CHAINS, BICYCLE, DRIVE AND BLOCK
Morse Chain Co., Ithaca, New York.

CHAINS, FOR ELEVATORS AND CONVEYORS
Can. Link-Belt Co., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Williams & Wilson, Ltd., Montreal, Que.

CHAIN, MALLEABLE, DETACHABLE AND RIVETED
Can. Link-Belt Co., Toronto, Ont.
Morse Chain Co., Ithaca, N.Y.
Williams & Wilson Ltd., Montreal, Que.

CHAINS, POWER TRANSMISSION
Morse Chain Co., Ithaca, N.Y.

CHAINS, SPROCKET WHEEL
Morse Chain Co., Ithaca, N.Y.

CHAIN DRIVES
Can. Link-Belt Co., Toronto, Ont.
Coventry Chain Co., Coventry, England
Jones & Glassco, Montreal, Que.
Morse Chain Co., Ithaca, N.Y.

CHASERS
National Acme Co., Cleveland, Ohio.
Taylor, J. A. M., 318 Stair Bldg., Toronto, Ont.

CHEMISTS
Toronto Testing Lab'tory, Ltd., Toronto

CHISELS
Whitman & Barnes Co., St. Catharines.

CHUCKS, AERO, AUTOMATIC
Garvin Machine Co., New York.

CHUCKS, CENTERING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, COLLET, AIR
Elliott & Whitehall Mach. & Tool Co. Galt, Ont.
Smalley General Co., Inc., Bay City, Mich.
Williams & Wilson, Ltd., Montreal, Que.

CHUCKS, DRILL, LATHE AND UNIVERSAL
Aikenhead Hardware Co., Toronto, Ont.
Almond Mfg. Co., Ashburnham, Mass.
Bicknell-Thomas Co., Greenfield, Mass.
Bertram & Sons Co., John, Dundas.
Can. Blower & Forge Co., Kitchener, Ont.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cushman Chuck Co., Hartford, Conn.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt., & Son, Montreal
Garlock-Walker Mach'y Co., Toronto.
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Chicago, Ill.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Modern Tool Co., Erie, Pa.
Rice Lewis & Son, Toronto, Ont.
Skinner Chuck Co., New Britain, Conn.
Whiton Machine Co., D. E., New London, Conn.
Williams & Wilson, Ltd., Montreal, Que

CHUCKS, DRILL, AUTOMATIC AND KEYLESS
Aikenhead Hardware Co., Toronto, Ont
Bicknell-Thomas Co., Greenfield, Mass.
Can. Blower & Forge Co., Kitchener.
Whitney Mfg. Co., Hartford, Conn.

CHUCKS FRICTION AND TAP
Bicknell-Thomas Co., Greenfield, Mass.
Vic[illegible] Tool Co., Warrenboro, Pa.

CHUCKS, MACHINE MILLING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CHUCKS, MAGNETIC
Heald Machine Co., Worcester, Mass.
Williams & Wilson, Ltd., Montreal, Que.

CHUCKS, RING WHEEL
Ford-Smith Mach. Co., Hamilton, Ont.
Gardner Machine Co. Beloit, Wis

CHUCKS, WHEEL, CAR
Hoggson & Pettis Mfg. Co., New Haven Conn.

CHUCKING MACHINES
Brown & Sharpe Mfg. Co., Providence, R.I.
Garvin Machine Co., New York.
Gisholt Machine Co., Madison, Wis.
National Acme Co., Windsor, Vt.
Niles-Bement-Pond Co., New York.
Roelofson Machine & Tool Co., Toronto.
Warner & Swasey Co., Cleveland, O.
Wood Turret Mach. Co., Brazil, Ind.
Williams & Wilson, Ltd., Montreal, Que

CIRCULATING SYSTEMS FOR LUBRICATING OIL
Power Co., Ltd., S. F., Toronto, Ont.
Williams & Co., J. H., Brooklyn, N.Y.

CLAMPS, BELT
Hoggson & Pettis Mfg. Co., New Haven, Conn.

CLEANERS, METER, WASTE, GENERAL
Oakley Chemical Co., New York, N.Y.

CLEANING COMPOUND
Oakley Chemical Co., New York

CLOCK SPRINGS
The Dunbar Brothers Co., Bristol, Conn.

CLOCKS, WATCHMAN, PORTABLE
Gisholt Machine Co., Madison, Wis.
Hardinge Bros., Inc., Chicago, Ill.

CLUTCHES, CHAIN
Wright Mfg. Co., Lisbon, Ohio.

CLUTCHES, FRICTION AND PULLEY
Bernard Industrial Co., A., Fortierville, Q.
Can. Link-Belt Co., Toronto, Ont.
Carlyle Johnson Mach. Co., Manchester, Conn.
Positive Clutch & Pulley Wks., Toronto, Ont.
Jones & Glassco, Montreal, Que.
Williams & Wilson, Ltd., Montreal, Que.

COAL HANDLING MACHINERY
Can. Link-Belt Co., Toronto, Ont.
Dominion Bridge Co., Montreal, Que.
MacGovern & Co., Montreal, Que.
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville, Ont.
Williams & Wilson, Limited, Montreal.
Nova Scotia Steel & Coal Co., New Glasgow, N.S.

COLD ROLLED STRIP, ALL METAL COLLARS, SHAFTING
Can. Driver-Harris Co., Ltd., Walkerville.
Wilson & Co., J. C., Belleville, Ont.
Williams & Co., J. H., Brooklyn, N.Y.
Williams & Wilson Ltd., Montreal, Que

COLLECTORS, PNEUMATIC
Can. Blower & Forge Co., Kitchener.
J. C. Wilson & Co., Belleville, Ont.

COLLETS
Becker Milling Machine Co., Boston.
Hardinge Bros., Inc., Chicago, Ill.
Wilson & Co., J. C. Belleville, Ont.

COMPOSITION INGOT
Brown's Copper & Brass Rolling Mills, New Toronto.
Canada Metal Co., Toronto, Ont.

COMPOUNDS, CUTTING AND GRINDING, DRAWING, STAMPING
Oakley Chemical Co., New York, N.Y.

COMBINED OPEN SIDE PLANER-SHAPER
Lynd-Farquhar Co., Boston, Mass.

COMPRESSORS, AIR
Can. Ingersoll Rand Co., Sherbrooke.
Cleveland Pneumatic Tool Co., Toronto.
Curtis Pneumatic Machy. Co., St. Louis
Elliott & Whitehall, Galt, Ont.
Garlock Walker Machy. Co., Toronto.
Hinckley Machine Co., Hinckley, Ill.
MacGovern & Co., Montreal, Que.
Williams & Wilson, Ltd., Montreal, Que

CONDENSERS
MacGovern & Co., Montreal, Que.
Smalley General Co., Inc., Bay City, Mich.

CONNECTING RODS
Canada Found'ls & Forgings, Ltd., Welland, Ont.

CONTRACT WORK
Brown Engineering Corp., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Homer & Wilson, Hamilton, Ont.
Katie Foundry, Ltd., Galt, Ont.
Marten Machine Co., Hamilton, Ont.
St. Lawrence Welding Co., Montreal.
Victoria Foundry Co., Ottawa.
Wilson & Co., J. C., Belleville, Ont.
Windsor Mach. Tool Co., Windsor, Ont.

CONTROLLERS, MAGNETIC BRAKES, ELEC. WINCHES, MONO RAIL HOISTS
Volta Mfg. Co., Welland, Ont.

CONTROLLERS AND STARTERS
Williams Mach'y Co., A. R., Toronto.

CONTROLLING INSTRUMENTS
Taylor Instrument Co., Rochester, N.Y.

CONVERTERS, ROTARY
MacGovern & Co., Montreal, Que.

CONVEYORS, BELT AND CHAIN
Can. Link-Belt Co., Toronto, Ont.
Jones & Glassco, Montreal

CONVEYORS, OVERHEAD
Beatty Bros., Fergus, Ont.

COOLERS, WITH DRINKING FOUNTAINS
Puro Sanitary Drinking Fountain Co., Haydenville, Mass

COPING MACHINES
Bertram & Sons Co., John, Dundas, Ont.
Garlock-Walker Machinery Co., Toronto.
Niles-Bement-Pond Co., New York.
Can. Blower & Forge Co., Kitchener.

COPPER, BUS BAR, SHEET, PATES, RODS
Brown's Copper & Brass Rolling Mills, New Toronto Ont

COTTER PINS
Whitman & Barnes Co., St. Catharines.

COUNTERBORES AND COUNTERSINKS
Aikenhead Hardware Co., Toronto, Ont.
Blancke Co., L. C., New York City.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.

COUNTERSHAFTS
Almond Mfg. Co., Ashburnham, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Gray Ball Bearing Co., Ltd., Toronto.
Baird Machine Co., Bridgeport, Conn.
Ford-Smith Machine Co., Hamilton, Ont.
Foster Machine Co., Elkhart, Ind.
Williams & Wilson, Ltd., Montreal, Que.

COUPLINGS, FRICTION
Bernard Industrial Co., The A., Fortierville, Que.
Can. Link-Belt Co., Toronto, Ont.
Williams & Wilson Ltd., Montreal, Que

COUPLINGS, RAPID HOSE
Int. Machinery & Supply Co., Ltd., Montreal, Que.

COILING MACHINERY, WIRE AND SPRING
Garlock-Walker Machinery Co., Toronto.

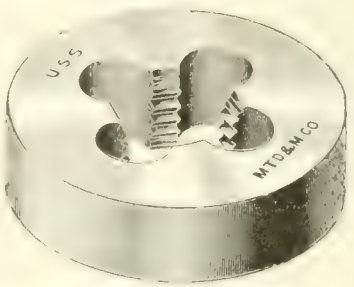
COKE AND COAL
Hanna & Co., M. A., Cleveland, O.



"MORSE" ROUND DIES

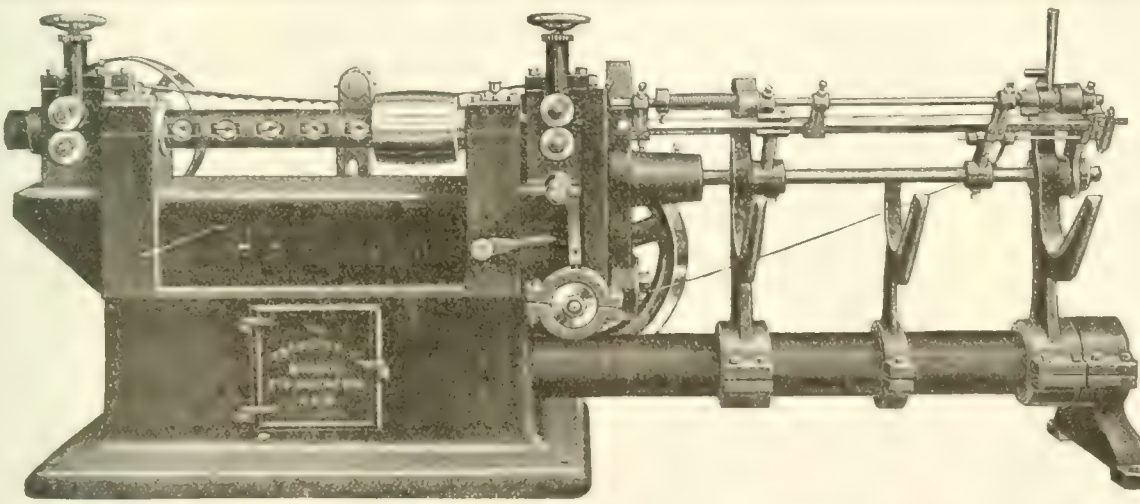
FURNISHED IN EITHER SOLID OR ADJUSTABLE TYPES, SINGLY OR IN SETS. V. U.S.S. or WHITWORTH SHAPE of THREAD.

THESE DIES CUT CLEAN, ACCURATE THREADS AND HOLD THEIR SIZE.



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Automatic Wire Straightening and Cutting Machine

Just put your coil of wire on the reel, adjust the rolls and dies, and set the gauge for the length you want. The machine does the rest—thousands of feet per day, perfectly straight and cut to accurate lengths.

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Cleveland Pneumatic Tool Co., of Canada, Toronto
Gardner Robt. & Son, Montreal.
Independent Pneumatic Tool Co., Chicago
Wilson & Co., J. C., Belleville, Ont.

CRANES, LOCOMOTIVE
Can. Link-Belt Co., Toronto, Ont.
Northern Crane Works, Walkerville

CRANES, OVERHEAD, HAND AND ELECTRIC
Volta Manufacturing Co., Welland, Ont

CUPS, OIL
Can. Winkley Co., Ltd., Windsor, Ont.

COVERS, OIL HOLE
Can. Winkley Co., Ltd., Windsor, Ont.

CRANES, GANTRY
Can. Link-Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.

CRANE RUNWAYS
MacKinnon Steel Co., Sherbrooke, Que.

CRANES, GOLIATH, PNEUMATIC AND PORTABLE
Morris Crane and Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Wilson & Co., J. C., Belleville.
Williams & Wilson, Ltd., Montreal, Que.

CRANES, TRAVELLING, ELECTRIC AND HAND POWER
Can. Link-Belt Co., Toronto, Ont
Curtis Pneumatic Machy. Co., St. Louis
Dominion Bridge Co., Montreal.
Hepburn, John T., Ltd., Toronto
MacKinnon Steel Co., Sherbrooke, Que.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.

CRANK SHAFTS
Canada Found'n & Forgings Ltd., Welland
Williams & Co., J. H., Brooklyn, N.Y.

CRANES, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Link-Belt Co., Toronto.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Northern Crane Works, Walkerville.
Rice Lewis & Son, Toronto, Ont.
J. C. Wilson & Co., Belleville, Ont.
Williams & Wilson, Ltd., Montreal, Que.

CRIMPS, LEATHER
Graton & Knight Mfg. Co., Worcester, Mass.

CRUSHERS
Elec. Steel & Metals, Welland, Ont.

CUPOLAS
Can. Blower & Forge Co., Kitchener.
Northern Crane Works, Walkerville.

CURB PUMPS FOR OIL, GASOLINE
Bowser Co., Ltd., S. F., Toronto, Ont.

CURRENT TRANSFORMERS
Volta Manufacturing Co., Welland, Ont.

CUT-OFF COUPLINGS, FRICTION
J. C. Wilson & Co., Belleville, Ont.
Williams & Wilson, Ltd., Montreal, Que.

CUTTERS, BOLT
See Bolt Cutters.

CUTTERS, GEARS
Brown & Sharpe Mfg. Co., Providence, R.I.
Butterfield & Co., Inc., Rock Island, Que.
Fellows Gear Shaper Co., Springfield, Vt.

CUTTERS, FLUE
Cleveland Pneumatic Tool Co., Toronto.

CUTTER HEADS
Oliver Machinery Co. Grand Rapids, Mich

CUTTERS, PIPE (See Pipe Cutters)

CUTTERS, MILLING
Becker Milling Mach. Co., Boston, Mass.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Cleveland Twist Drill Co., Cleveland.
Davidson Tool Mfg. Co., New York, N.Y.
Elliott & Whitehall Mach. & Tool Co., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garvin Machine Co., New York.
Illinois Tool Works, Chicago, Ill.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Pilot Steel & Tool Co., Montreal, Que.
Rice Lewis & Son, Toronto, Ont.
Tabor Mfg. Co., Philadelphia, Pa.
Whitney Mfg. Co., Hartford, Conn

CUTTER RELIEVING MACHINES
Cleveland Milling Machine Co., Cleveland.

CUTTING-OFF MACHINES
Armstrong Bros., Tool Co., Chicago.
Bertram & Sons Co., John, Dundas.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Ltd., Montreal
Curtis & Curtis Co., Bridgeport, Conn.
Foss Mchy & S'ply Co., Geo. F., Montreal
Garlock-Walker Machinery Co., Toronto.
Garvin Machine Co., New York.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hurlburt, Rogers Machy. Co., South Sudbury, Mass.
Hall & Sons, John H., Brantford, Ont.
Kennedy & Sons, Wm., Owen Sound.
Niles-Bement-Pond Co., New York, N.Y.
Peerless Machine Co., Racine, Wis.
Prest-O-Lite Co., Inc., Toronto, Ont.
Racine Tool & Machine Co., Racine, Wis
Tabor Mfg. Co., Philadelphia, Pa.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que.

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Cataract Refining Co., Ltd., Toronto.

CUTTING OIL, RECLAIMING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

CUTTING AND WELDING PLANTS
Davis-Bournonville Co., Jersey City, N.J.
Prest-O-Lite Co., Inc., Toronto, Ont.
Welding & Supplies Co., Montreal, Que.

CYANIDE AND LEAD BATH POTS
Swedish Crucible Steel Co., Windsor.

CYLINDERS, AIR
Ford-Smith Machine Co., Hamilton, Ont.
Smalley General Co., Inc., Bay City, Mich

CYLINDERS, AUTOMATIC REBORING JIGS AND REAMERS
Hinckley Machine Co., Hinckley, Ill.
Kelley Reamer Co., Cleveland, O.

DEHUMIDIFYING
B. F. Sturtevant Co, Galt, Ont.

DERRICKS
Aikenhead Hardware Co., Toronto, Ont.
Dominion Bridge Co., Montreal.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.

DIAMOND TOOLS
Ford-Smith Machine Co., Hamilton, Ont.
Joyce-Koebel Co., Inc., New York City.
Wheel Trueing Tool Co., Detroit.
Williams & Wilson, Limited, Montreal.

DIAMONDS, CARBON AND BORTZ
Wheel Trueing Tool Co., Detroit.

DIAMONDS, BLACK AND ROUGH
Joyce, Koebel & Co., Inc., New York.
Wheel Trueing Tool Co., Windsor, Ont.

DIE BLOCKS
General Steel Co., Milwaukee, Wis.

DIES, CUTTING
Hoggson & Pettis Mfg. Co., New Haven, Conn.

DIE HEADS, AUTOMATIC
Greenfield Tap & Die Corp., Greenfield Mass.
Wells Bros. of Can., Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que.

DIES, BRASS PRINTING, EMBOSSING AND LETTERING
Matthews, Jas. H., & Co., Pittsburgh, Pa

DIES FOR BIT BRACE USE
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Wells Brothers Co., of Canada, Galt.

DIES AND DIE STOCKS
Aikenhead Hardware Co., Toronto, Ont.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Boker & Co., Inc., H., Montreal, Que.
Butterfield & Co., Rock Island, Que.
Brown, Boggs Co., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Gardner, Robt. & Son, Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Marshall, Son & Bunney, Toronto.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., Cleveland, Ohio.
Pilot Steel & Tool Co., Montreal, Que.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Rickert-Shafer Co., Erie, Pa.
Stoll Co., Inc., D. H., Buffalo, N.Y.
Wells Brothers of Canada, Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que

DIES, METAL STAMPING
Elliott & Whitehall, Galt, Ont.

DIES, PIPE THREADING
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Williams & Wilson, Ltd., Montreal, Que.

DIES, THREADING
Butterfield & Co., Inc., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Can., Galt, Ont.

DIE SINKERS
Becker Milling Machine Co., Boston
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont.

DIES FOR MACHINES
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Rock Island, Que.
Firth & Sons, Thos., Montreal, Que.
Landis Machine Co., Waynesboro, Pa.
Wells Brothers Co. of Canada, Galt.

DIE HEADS
Greenfield Tap & Die Corp., Greenfield, Mass.
Wells Bros. of Canada, Galt, Ont.

DIES, SELF-OPENING
Geometric Tool Co., New Haven.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Wells Brothers Co. of Can., Galt, Ont.
Williams & Wilson, Ltd., Montreal, Que.

DIE FILING MACHINES
Oliver Mach. Co., Grand Rapids, Mich.

DIE STEEL, HOT AND COLD WORK
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Marshall, Son & Bunney, Toronto.
Firth & Sons, Thos., Montreal, Que.
Kayser-Ellison & Co., Ltd., Montreal.
Norton, Ralph B., Agent, Montreal

DIES FOR SCREW PLATES
Butterfield & Co., Inc., Rock Island, Que.
Wells Bros. Co. of Can., Galt, Ont.

DIES, SHEET METAL WORKING
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Canada
Illinois Tool Works, Chicago, Ill.
Marten Machine Co., Hamilton, Ont.
Stoll Co., D. H., Buffalo, N.Y.

DIES, SCREW AND THREAD
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
National-Acme Co., Cleveland, Ohio.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., of Can., Galt, Ont.

DISCS, LEATHER, STEEL
Graton & Knight Mfg. Co., Worcester, Mass.
Swedish Steel & Importing Co., Montreal.

DIRECT CONNECTED UNITS
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DRAFT, MECHANICAL
W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
A. B Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.

DRAWING INSTRUMENTS
Hughes, Owens Co., Ltd., Montreal, Que.

DRAWING OFFICE SUPPLIES
Hughes, Owens Co., Ltd., Montreal, Que.

DRESSERS, GRINDING AND EMERY WHEEL
Can. Desmond-Stephan Mfg. Co., Hamilton
Dominion Abrasive Co., Ltd., Mimico, Ont
Wheel Trueing Tool Co., Windsor, Ont.
Williams & Wilson, Limited, Montreal

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Aurora Tool Works, Aurora, Ind.
W. F. & John Barnes Co., Rockford.
Can. Blower & Forge Co., Kitchener.
Canada Machinery Corp., Galt, Ont.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Machinery Co., Toronto
Garvin Machine Co., New York.
A. B. Jardine & Co., Ltd., Hespeler, Ont.
Niles-Bement-Pond Co., New York.
U. S. Mach. Tool Co., Cincinnati, Ohio.
A. R. Williams Machinery Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

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Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto.
Norton, Ralph B., Agent, Montreal.
Swedish Steel & Importing Co., Ltd., Montreal.

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Barnes, W. F. & John, Co., Rockford, Ill.
Bilton Mach. Tool Co., Bridgeport, Conn
Canada Machinery Corp., Galt, Ont.
Silver Mfg. Co., Salem, Ohio.
Williams & Wilson, Ltd., Montreal, Que.

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John Bertram & Sons Co., Dundas.
Bilton Mach. Tool Co., Bridgeport, Conn.
Can. Blower & Forge Co., Kitchener, Ont
Canada Machinery Corp., Galt, Ont.
Can. Fairbanks-Morse Co., Montreal.
Foss Mchy. & S'ply Co., G. F., Montreal.
Garlock-Walker Mach. Co., Toronto.
Garvin Machine Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Henry & Wright Mfg. Co., Hartford, Conn
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
Nat. Automatic Tool Co., Richmond, Ind.
Niles-Bement-Pond Co., New York.
Rockford Drilling Mach Co., Rockford, Ill

DRILLING MACHINES, RADIAL AND TURRET
John Bertram & Sons Co., Dundas
Canadian Fairbanks-Morse Co., Montreal.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machinery Co., Toronto.
Henry & Wright Mfg. Co., Hartford,
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Williams & Wilson Limited, Montreal.

DRILLING MACHINES, SENSITIVE
Bilton Mach. Tool Co., Bridgeport, Conn.
W. F. & John Barnes Co., Rockford, Ill.
Canadian Fairbanks-Morse Co., Montreal.
Canadian Machinery Corp., Galt, Ont.
Geo. F. Foss Mch. & S'ply Co., Montreal
Garlock-Walker Mach. Co., Toronto, Ont.
Henry & Wright Mfg. Co., Hartford, Conn.
Landis Tool Co., Waynesboro, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
United States Mach. Tool Co., Cincinnati
Williams & Wilson Limited, Montreal,

DRILLING MACHINES, UPRIGHT AND HORIZONTAL
Aurora Tool Works, Aurora, Ind.
John Bertram & Sons Co., Dundas.
Garlock-Walker Mach. Co., Toronto, Ont
Can. Blower & Forge Co., Kitchener.
Canada Mach. Corp., Galt, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Garlock-Walker Mach. Co., Toronto, Ont.
Hoefer Mfg. Co., Freeport, Ill.
A. B. Jardine & Co., Hespeler, Ont.
Landis Tool Co., Waynesboro, Pa.
R. McDougall Co., Galt.
Nat. Automatic Tool Co., Richmond, Ind.
Rockford Drilling Mach. Co., Rockford, Ill
Niles-Bement-Pond Co., New York.
Silver Mfg. Co., Salem, Ohio.
A. R. Williams Machinery Co., Toronto.
Williams & Wilson, Ltd., Montreal, Que.

DRILLING MACHINES, SPECIAL
Hoefer Mfg. Co., Freeport, Ill.

DRILLING MACHINES, WALL RADIAL
Lynd-Farquhar Co., Boston, Mass.
Wickes Bros, Saginaw, Mich.

DRILLING POSTS
Aikenhead Hardware Co., Toronto, Ont.
Keystone Mfg. Co., Buffalo, N.Y.
Rice Lewis & Son, Toronto, Ont.
Silver Mfg. Co., Salem, Ohio.

DRILLS, BENCH
Aikenhead Hardware Co., Toronto.
W. F. & John Barnes Co., Rockford, Ill
Can. Blower & Forge Co., Kitchener.
Can. Fairbanks-Morse Co., Montreal.
Geo. F. Foss Mch. & S'ply Co., Montreal
Fry's (London), Ltd., London, England
Garlock-Walker Machinery Co., Toronto.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
U.S. Electrical Tool Co., Cincinnati, O.
Williams & Wilson, Ltd., Montreal, Que.

DRILLS, CENTRE
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Machine Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilt Twist Drill Co. of Can., Walkerville
Williams & Wilson, Ltd., Montreal, Que.

DRILLS, BLACKSMITH AND BIT STOCK
Aikenhead Hardware Co., Toronto, Ont.
Butterfield & Co., Inc., Rock Island, Que.
Can. Blower & Forge Co., Kitchener.
Cleveland Twist Drill Co., Cleveland.
Geo. F. Foss Mch. & S'ply Co., Montreal
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilkinson & Kompass, Hamilton, Ont.
Wilt Twist Drill Co. of Can., Walkerville

DRILLS, CARBON
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Inc., Rock Island, Que.
Marshall, Son & Bunney, Toronto.
John Morrow Screw & Nut Co., Ingersoll

DRILLS, ELECTRIC, PORTABLE
Aikenhead Hardware Co., Toronto, Ont.
Can. Blower & Forge Co., Kitchener.
Boker & Co., Inc., H., Montreal, Que.
Cincinnati Electrical Tool Co., Cincinnati
Geo. F. Foss Mch. & S'ply Co., Montreal
Independent Pneumatic Tool Co., Chicago.
Niles-Bement-Pond Co., New York.
Pilot Steel & Tool Co., Montreal, Que.
Prest-O-Lite Co., Inc., Toronto, Ont.
U. S. Electrical Tool Co., Cincinnati, O.
A. R. Williams Mach. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal, Que.

DRILLS, EMERY.
Garlock-Walker Mach. Co., Toronto, Ont.

DRILLS, HIGH SPEED TWIST
Aikenhead Hardware Co., Toronto, Ont.
Armstrong-Whitworth of Can., Montreal.
Atkins & Co., Ltd., Wm., Sheffield, Eng.
Butterfield & Co., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Canadian Fairbanks-Morse Co., Montreal
H. A. Drury Co., Montreal.
Geo. F. Foss Mch. & S'ply Co. Montreal
Marshall, Son & Bunney, Toronto.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Machine Co., New Bedford, Mass.
W. F. & John Barnes Co., Rockford, Ill
Plewes, Ltd., Winnipeg, Man.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Taylor J. A. M., Stair Bldg., Toronto.
Whitman & Barnes Mfg. Co., Akron, O.
Wilt Twist Drill Co. of Can., Walkerville
Wilkinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal, Que

DRILLS, OIL TUBE
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto, Ont.

DRILLS, PNEUMATIC
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
Independent Pneumatic Tool Co. Chicago.
Niles-Bement-Pond Co., New York.
Williams & Wilson, Limited, Montreal.

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DRILLS, PNEUMATIC CORNER
Can. Ingersoll-Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Garlock Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.

DRILLS, RATCHET AND HAND
Aikenhead Hardware Co., Toronto, Ont.
Armstrong Bros. Tool Co., Chicago, Ill.
Can. Blower & Forge Co., Kitchener, Ont.
Canadian Fairbanks-Morse Co., Montreal.
Cincinnati Electrical Tool Co., Cincinnati.
Cleveland Twist Drill Co., Cleveland.
Garlock Walker Mchy. Co., Toronto, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Morrow Screw & Nut Co., John, Ingersoll, Ont.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Dundas, Ont.
Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., Akron, O.
Wilt Twist Drill Co. of Can., Walkerville.

DRILLS, ROCK
Can. Ingersoll Rand Co., Montreal, Que.
Cleveland Pneumatic Tool Co., Toronto.
The Foss Mchy. & Supply Co., Montreal.
A. R. Williams Machy. Co., Toronto.

DRILLS, TRACK
Butterfield & Co., Inc., Rock Island, Que.
Cleveland Twist Drill Co., Cleveland.
The Foss Mchy. & Supply Co., Montreal.
Morrow Screw & Nut Co., J., Ingersoll, Ont
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Wilt Twist Drill Co. of Can., Walkerville.

DRINKING FOUNTAINS, SANITARY
Puro Sanitary Drinking Fountain Co., Haydenville, Mass.

DRIVES, CHAIN
See Belting, Chain.

DRIVING TOOLS
The Thos. Pink Co., Ltd., Pembroke, Ont.

DRY CLEANING SYSTEM
Bowser Co., Ltd., S. F., Toronto, Ont.

DRYERS, SAND
Pangborn Corporation, Hagerstown, Md.

DRYING APPLIANCES
Baird Machine Co., Bridgeport, Conn.
W. S. Rockwell Co., New York, N.Y.

DRUM CONTROLS
Volta Manufacturing Co., Welland, Ont.

DUMP CARS
Canadian Fairbanks-Morse Co., Montreal.
MacKinnon Steel Co., Sherbrooke, Que.

DUST EXHAUSTER, ARRESTER SYSTEM
Pangborn Corporation, Hagerstown, Md.

DUST HANDLING EQUIPMENT
Pangborn Corporation, Hagerstown, Md.

DUST SEPARATORS
Can. Blower & Forge Co., Kitchener, Ont.

DYNAMOS AND ELECTRICAL SUPPLIES
Canadian Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto
MacGovern & Co., Montreal, Que.
A. R. Williams Machy. Co., Toronto.

ELECTRICAL SUPPLIES
Can. General Electric Co., Toronto, Ont.

ELECTRIC FURNACES
Electro Furnace Construction Co., Philadelphia, Pa.
Volta Manufacturing Co., Welland, Ont.

EECTRIC FURNACE REGULATORS, WINCHES, ROOF COOLERS AND ELECTRODE HOLDERS
Volta Manufacturing Co., Welland, Ont.

ELECTRICAL RESISTANCE MATERIALS, NICHROME, KROMORE, CHROMAX, CLIMAX, NICKEL, SILVER, ADVANCE.
Can. Driver-Harris Co., Walkerville, Ont.

ELECTRIC HOISTS, STATIONARY AND MONO RAIL
Volta Manufacturing Co., Welland, Ont.

ELECTRIC MOTORS
Volta Manufacturing Co., Welland, Ont.

ELEVATOR, ENCLOSURES
Volta Mfg. Co., Welland, Ont.
Canada Wire & Iron Goods Co., Hamilton

ELEVATOR WEIGHTS
Katie Foundry, Galt, Ont.

ELEVATORS AND BUCKETS
Can. Link Belt Co., Toronto, Ont.
Curtis Pneumatic Machy. Co., St. Louis.
Williams & Wilson, Ltd., Montreal, Que.

ELEVATING AND CONVEYING MACHINERY
Can. Link Belt Co., Toronto, Ont.
Morris Crane & Hoist Co., Herbert, Niagara Falls, Ont.
Williams & Wilson, Ltd., Montreal, Que.

EMBOSSING PRESSES
Oliver Machinery Co., Grand Rapids, Mich

EMERY GRINDERS (PNEUMATIC)
Cleveland Pneumatic Tool Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.

EMERY AND EMERY WHEELS
Brantford Emery Wheel Co., Brantford, Canada
The Foss Mchy. & Supply Co., Montreal.
Garvin Machine Co., New York.
Canadian Fairbanks-Morse Co., Montreal.
Canada Emery Wheels Co., Hamilton.
Dominion Abrasive Wheel Co., Ltd., Munro, Ont
Ford-Smith Mach. Co., Hamilton, Ont.
Rice Lewis & Son, Toronto, Ont.
Standard Machy. & Supplies, Montreal.
Wickinson & Kompass, Hamilton, Ont.
Williams & Wilson, Ltd., Montreal, Que.
Dominion Abrasive Wheel Co., Ltd., Munro, Ont

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Dominion Abrasive Co., Ltd., Munro, Ont
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Dominion Bridge Co., Montreal, Que.
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Garlock-Walker Machinery Co., Toronto.
Independent Pneumatic Tool Co., Chicago.
Wells Bros. Co. of Canada, Galt, Ont.

HOSE, ALL KINDS

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HOSE, SAND BLAST

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Perrin, Ltd., William R., Toronto.
West Tire Setter Co., Rochester, N.Y.
Victoria Foundry Co., Ottawa.
Williams & Wilson, Limited, Montreal.

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Taylor Instrument Co., Rochester, N.Y.

INDICATORS, SPEED

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Brown & Sharpe Mfg. Co., Providence.
Starrett Co., L. S., Athol, Mass.

INDEX CENTRES

Brown & Sharpe Mfg. Co., Providence, R.I.
Dickow, Fred. C., Chicago, Ill.
Ford-Smith Machine Co., Hamilton, Ont.
Garvin Machine Co., New York.
Williams & Wilson, Limited, Montreal.

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Taylor Instrument Co., Rochester, N.Y.

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Homer & Wilson, Hamilton, Ont.
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Morton Mfg. Co., Muskegon Heights, M.
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Northern Crane Works, Walkerville.

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Can. General Electric Co., Toronto, Ont.

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LATH

Robertson, Ltd., H. H., Sarnia, Ont.

LATHES, CHUCKING

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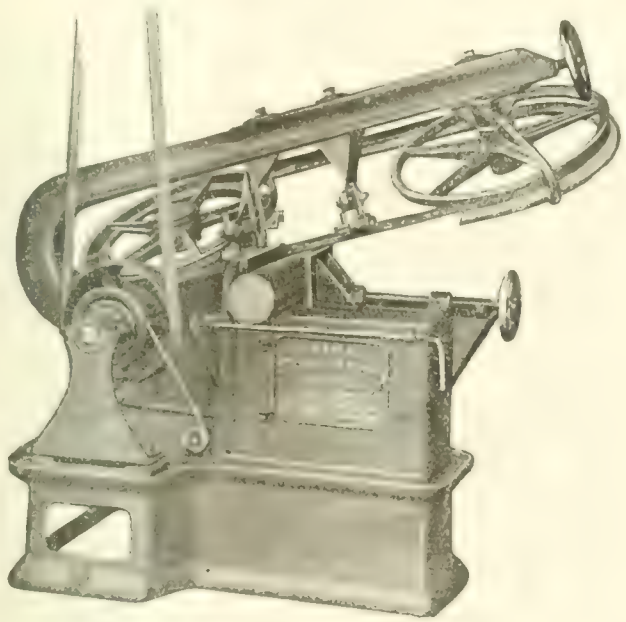
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Cut your Metal faster—

more accurately—more economically—with this



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Height, floor to table, 26¾″.
Length of Band Saw, 12′ 3″.
Size of Band Saw, 1″ x .035″.
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Power required, 1 H.P.
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FEATURES:

Continuous cutting—hence FAST.
Gravity feed—EASY on saw.
Roller guides—ensuring SQUARE, ACCURATE cuts.
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The ONLY Horizontal Band Saw Made

SAVES METAL—because the cutting band is only .035″ thick, and less metal is removed than with any other machine. Compare it with a cold saw's gash!

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Speed up your hand and power hack saws by using NAPIER blades!

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See Steel.

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Williams & Wilson, Ltd., Montreal, Que.

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Hall & Son, J. H., Brantford, Ont.
Jardine & Co., A. B., Hespeler.
Landis Machine Co., Waynesboro, Pa.
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Williams & Wilson, Ltd., Montreal, Que.

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Heat Under Accurate Control

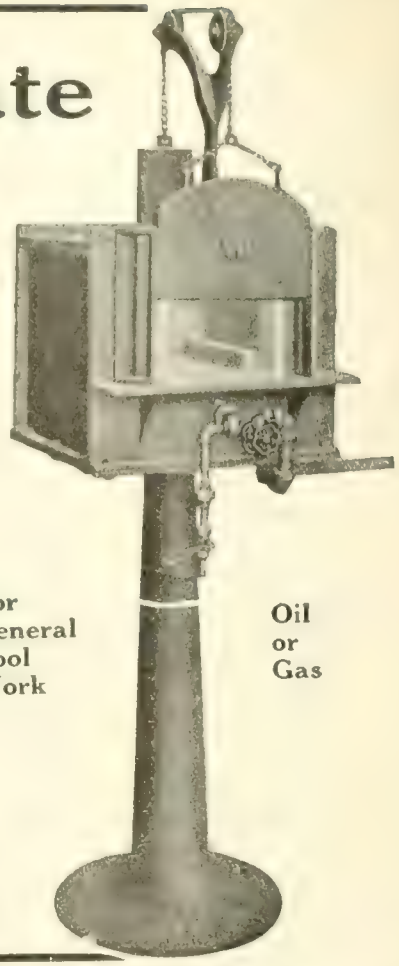
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These tool forges are particularly adapted for the requirements of the small machine shop for annealing and tempering dies, cutters, reamers, etc.

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For General Tool Work

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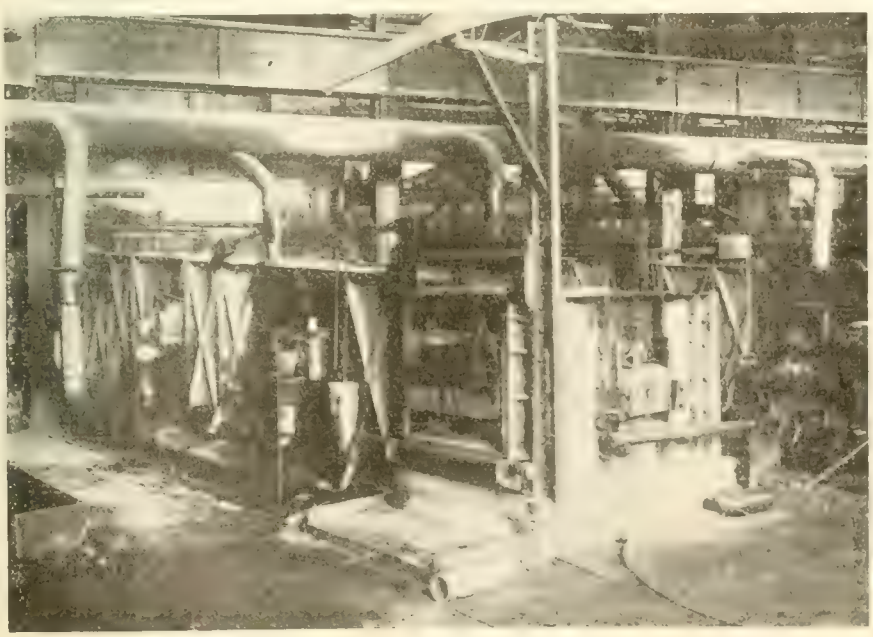
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John Morrow Screw & Nut Co., Ingersoll.
National Acme Co., Montreal.
Rice Lewis & Son, Toronto.
Steel Co. of Canada, Ltd., Hamilton.
Wilkinson & Kompass, Hamilton.

SCREW COLLARS
Galt Machine Screw Co., Ltd., Galt, Ont.
John Morrow Screw & Nut Co., Ingersoll.

SCREW MACHINES, PLAIN WIRE FEED
Brown & Sharpe Mfg. Co., Providence, R.I.

SCREW PLATES
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corp., Greenfield.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Rice Lewis & Son, Toronto.
J. A. M. Taylor, Stair Bldg., Toronto.
Wells Bros. of Can., Galt.
Wilkinson & Kompass, Hamilton.

SCREWS, SAFETY SET
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SCREW SLOTTERS
Butterfield & Co., Inc., Rock Island, Que
Garvin Machine Co., New York.
National Acme Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

SEPARATATORS, MOISTENERS AND OIL FOR COMPRESSED AIR
Pangborn Corporation, Hagerstown, Md.

SELF-OPENING DIES
See Dies.

SEPARATORS, SAND
Pangborn Corporation, Hagerstown, Md.

SET SCREWS, SAFETY
Aikenhead Hardware Co., Toronto.
Bristol Co., Waterbury, Conn.
J. Morrow Screw & Nut Co., Ingersoll, Ont.
Wilkinson & Kompass, Hamilton.

SHANKS, STRAIGHT AND TAPER
Jacobs Mfg. Co., Hartford, Conn.

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Geo. F. Foss Mchy. & Sply. Co., Montreal
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Garlock Walker Mach'y Co., Toronto.
Hendey Machine Co., Torrington, Conn.
Hamilton Mach. Tool Co., Hamilton.
Milwaukee Shaper Co., Milwaukee, Wis.
Rice Mach. Tool Co., Hamilton
Williams & Wilson, Ltd., Montreal.

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Fellows Gear & Shaper Co., Springfield, V.

SHAFTING
Algoma Steel Corp., Sault Ste. Marie, O
Can. Fairbanks-Morse Co., Montreal
Garlock-Walker Machy. Co., Ltd., Toronto
Jones & Glasseo, Montreal.
Niles-Bement Pond Co., New York.
Can. Drawn Steel Co., Hamilton.
Pratt & Whitney Co., Dundas.
Rice, Lewis & Son, Toronto.
A. R. Williams Machy. Co., Toronto.
Wilkinson & Kompass, Hamilton, Ont.
Wilson & Co., J. C., Belleville, Ont.
Williams & Wilson, Ltd., Montreal, Que.

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Rice Lewis & Son, Toronto.

SHEARING MACHINES, ANGLE IRON, BAR AND GATE
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Bertrams Ltd., Edinburgh, Scotland.
Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Ltd., Toronto
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E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co. Ltd., Hamilton
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Canada Machinery Corp., Galt, Ont.
Garlock-Walker Machy. Co., Ltd., Toronto
Long & Allstatter Hamilton, Ohio.
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National Machy. Co., Tiffin, Ohio
Niles-Bement-Pond Co., New York
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Toledo Machine & Tool Co. Toledo, O
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The Quickwork Co., St. Mary's, Ohio.

SHEARS, PNEUMATIC
Toledo Machine & Tool Co., Toledo, Ohio.

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Peck, Stow & Wilcox Co., Southington.

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SHEARS, SPLITTING
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D. H. Stoll Co., Inc., Buffalo, N.Y.

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SHEARS SERPENTINE
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Rice Lewis & Son, Toronto, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
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SLINGS, CHAINS
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Canada Machinery Corp., Galt, Ont.
Garvin Machine Co., New York.
National-Acme Co., Cleveland, Ohio.
Niles-Bement-Pond Co., New York.

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MacKinnon Steel Co., Sherbrooke, Que.

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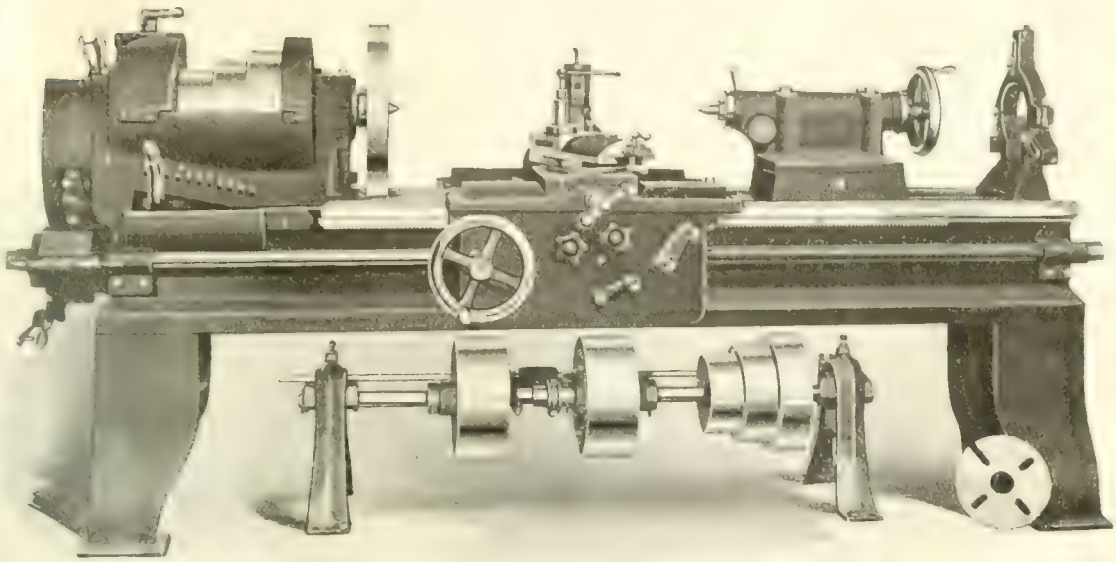
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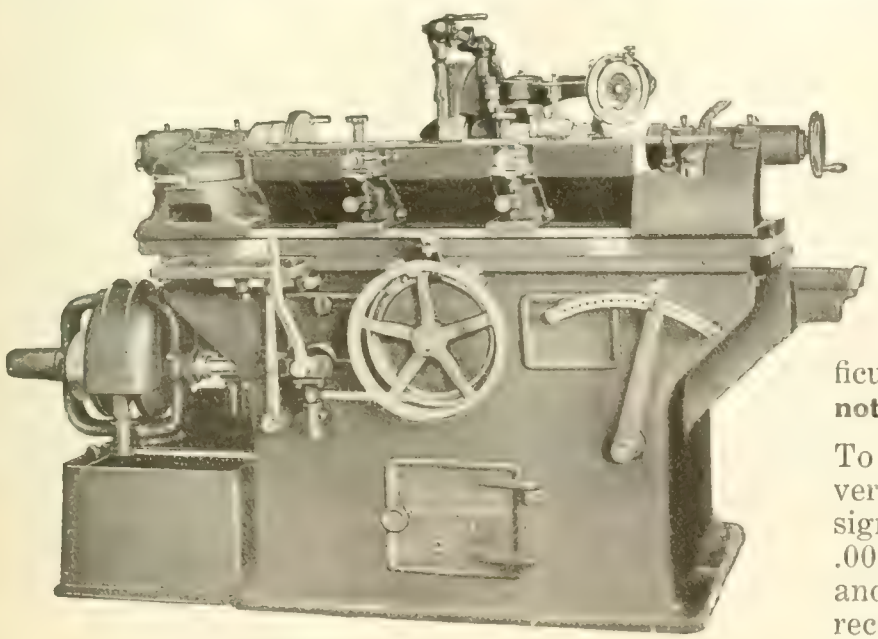
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Marshall, Son & Bunney, Toronto, Ont.
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STEEL, CRUSHED
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Kayser-Ellison & Co., Ltd., Montreal.
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MacKinnon Steel Co., Sherbrooke, Que.

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Hawkridge Bros. Co., Boston, Mass.
Kayser-Ellison & Co., Ltd., Montreal.
Marshall, Son & Bunney, Toronto, Ont.
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Wells Bros. of Can., Galt, Ont.

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Williams & Wilson, Ltd., Montreal, Que.

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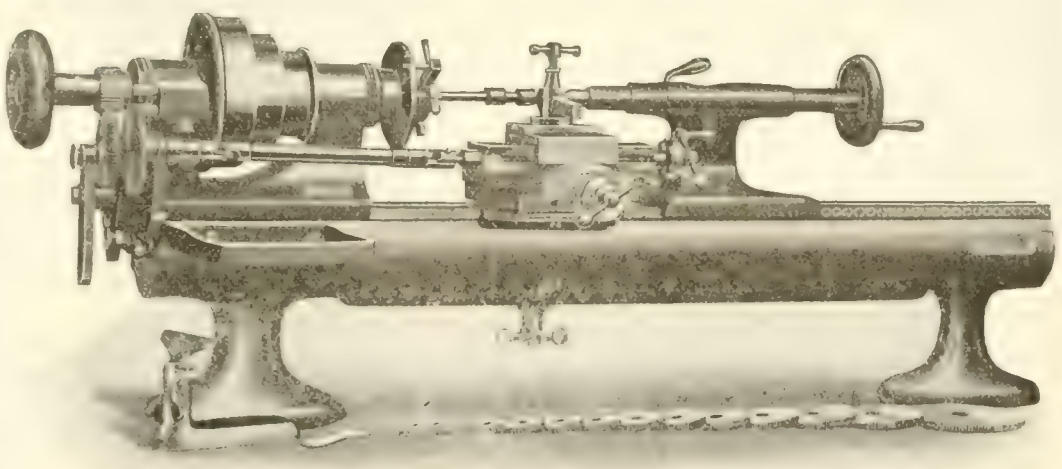
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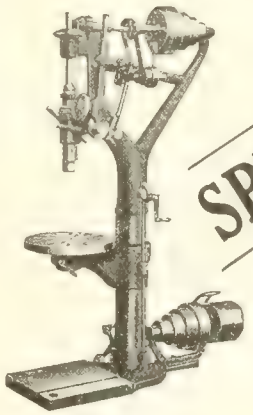
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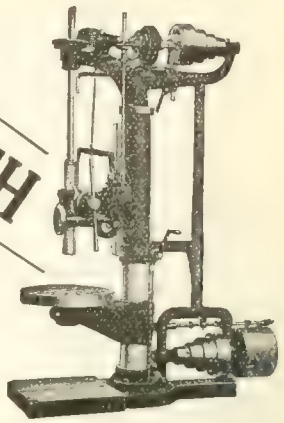
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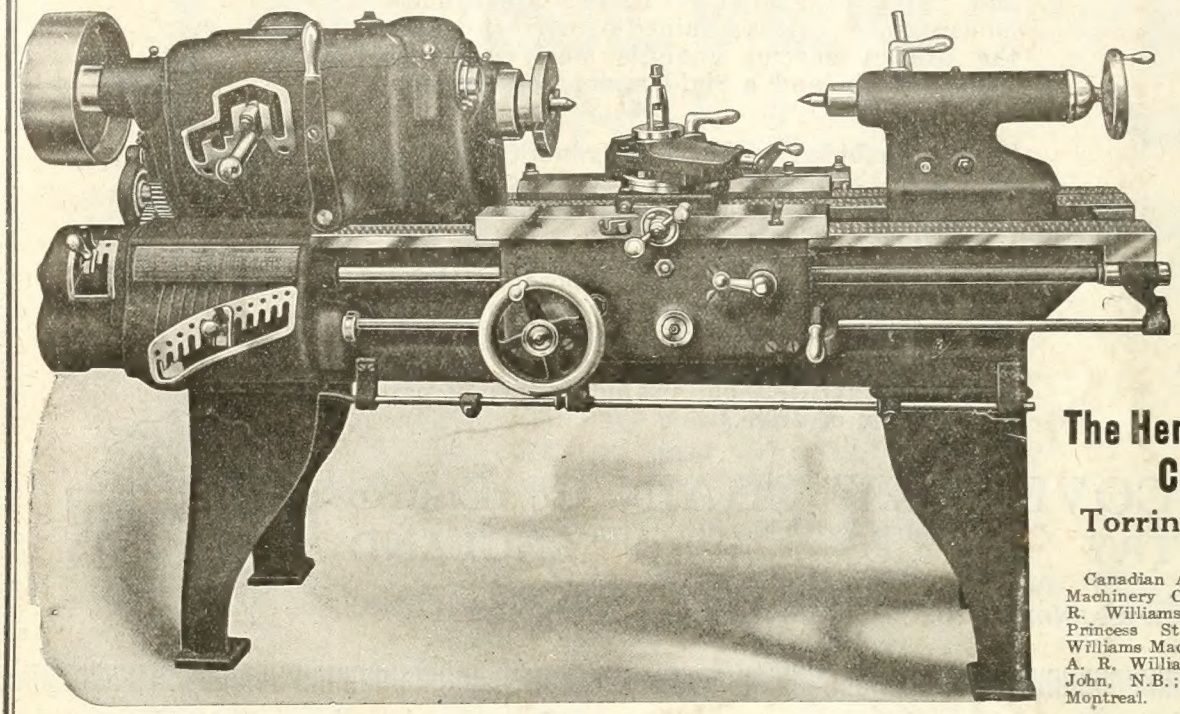
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Sturtevant Co., of Can., Ltd., B. F. 104
Swedish Crucible Steel Co. 160
Swedish Steel & Importing Co..... 18

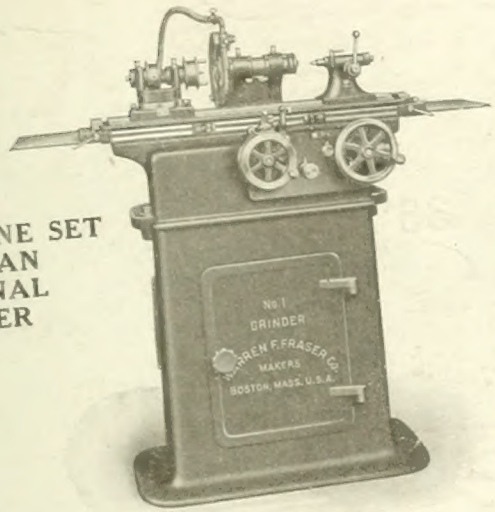
Continued on Page 163

Foss QUALITY Foss SERVICE Foss

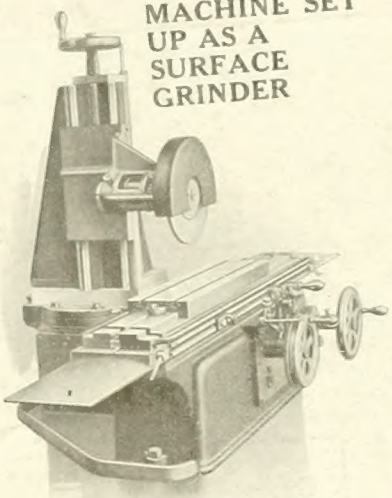
FRASER No. 1 Universal Convertible Grinder

(Patented May 28, 1918)

MACHINE SET UP AS AN INTERNAL GRINDER



MACHINE SET UP AS A SURFACE GRINDER



By the change of heads the machine can be converted into an efficient high-speed internal grinder; also a surface grinder of considerable range.

PATENTED APRON CONSTRUCTION. All the springs on this machine are enclosed and can be removed or replaced without disturbing any other part of the machine.

Capacity: Cylindrical work 8 in. x 2 in.
Surface work, 6 in. x 20 in.
and up to 8 in. in height.

Some of the Lines we represent:

Tungsten Hack Saw Blades
Moore Bros. Files
Gray Planers
Fraser Grinders
Mueller Radial Drills and Lathes
Sidney Engine Lathe
Cincinnati Electric Drills and Grinders
Elmira Wood Split Pulleys
Standard Bolt Cutters
Racine Hack Saw Machines
McArthur Beltings
Wallace Bench Planer
Kempsmith Milling Machines
Sebastian Lathes
Monarch Lathes
Champion Tools
Silver Drills
Sweetland Chucks
Smith & Mills Shapers
Boye & Emmes Lathes
Superior Grinding Wheels

...inery & Supply Co., Limited

...Que.

C.M.C.

PLANERS

SIZES 24" 30" 36" 42" and 48"

Any Length of Bed. Various Drives by Belt or Motor

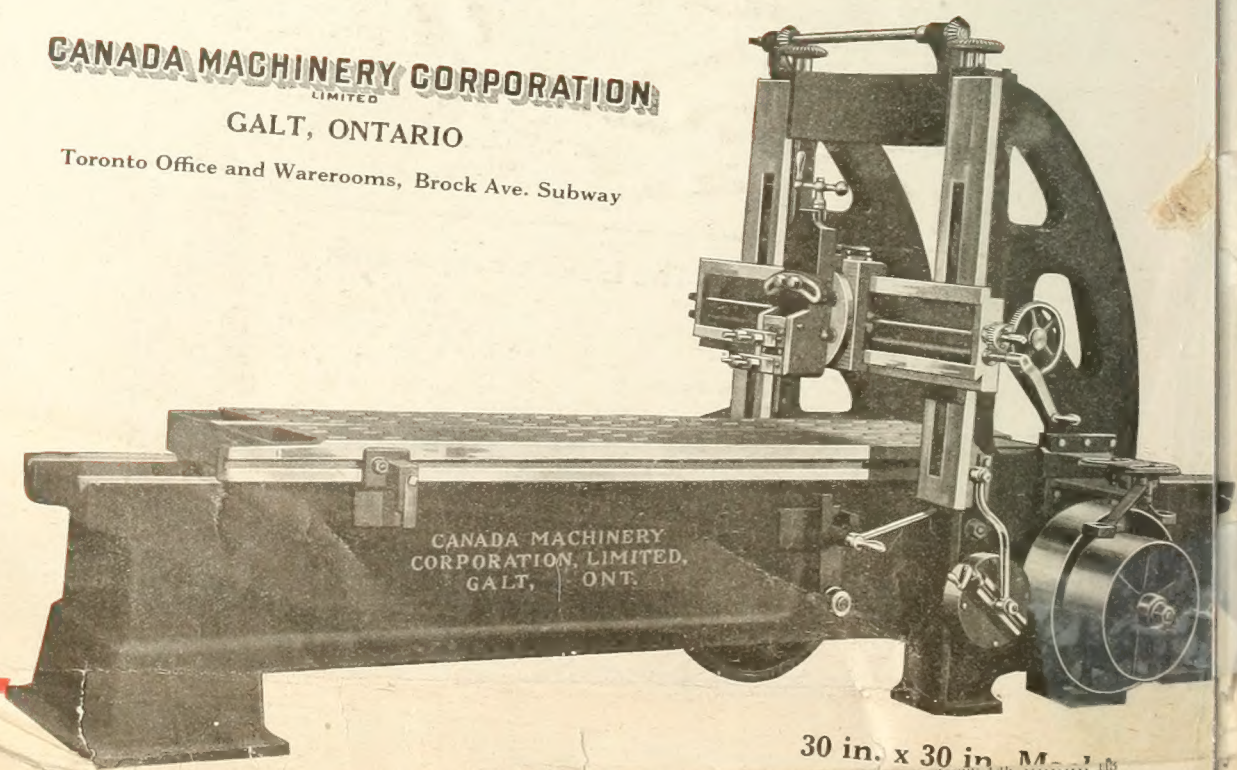
Number and Arrangement of Heads as Desired

Our planers are built to combine solidity and accuracy with convenience and speed of operation. An unstinted and intelligent use of metal gives the machine an absolute rigidity under heaviest cuts, while the operating mechanism and adjustments are as simple, effective and convenient as possible.

CANADA MACHINERY CORPORATION
LIMITED

GALT, ONTARIO

Toronto Office and Warerooms, Brock Ave. Subway



30 in. x 30 in. M...

Cleveland 151
Cleveland Tw... 33
Clipper Belt Lac... 127
... Acme Co. 164
... & Wright Mfg. Co. 106
Hepburn, John T. 128
High Speed Hammer 6
... Tool Co. 136
N
National Acme Co. 133
National Electro Products Ltd. 120
Nazel Eng. & Machine Works 19
... Co. 113
Stewart & Co., Duncan 30
Stoll Co., D. H. 140
Sturtevant Co., of Can., Ltd., B. F. 104
Swedish Crucible Steel Co. 150
Swedish Steel & Importing Co. 18

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